# CHEMICAL & METALLURGICAL ENGINEERING

Volume 46—Number 11

Established 1902

CONTENTS FOR NOVEMBER, 1939

A McGRAW-HILL PUBLICATION


## SEVENTEENTH CHEMICAL EXPOSITION NUMBER


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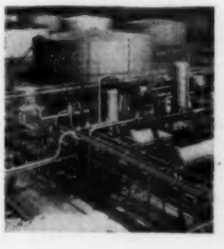

**Humble Oil's alkylation plant at Baytown, Texas, produces 250,000 bbl. per year of a new synthetic super-fuel used in 100-octane aviation gasolines. See pages 667 to 678 for other achievements of award-winning Standard Oil Development Co.** [*This cover space released for editorial use by Patterson Foundry & Machine Co.*]


Price of this issue, one dollar per copy

Published monthly, price 35 cents a copy. Subscription rates—United States, Canada, Mexico, Central and South American countries, $3.00 a year. All other countries, $5.00 a year or 20 shillings. Entered as second-class matter, September 2, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.


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McGRAW-HILL PUBLISHING COMPANY, INC.

JAMES H. McGRAW, Founder and Honorary Chairman

Publication office, 99-129 Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd St., New York, N. Y. Cable address, Mcgrawhill, N. Y. Branch Offices: 520 North Michigan Ave., Chicago; San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta

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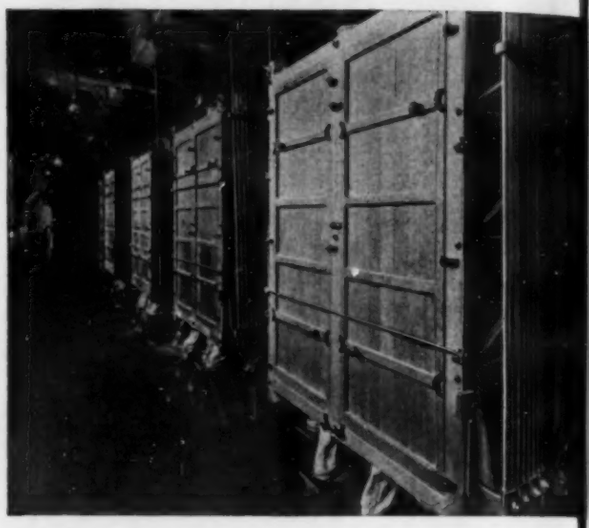

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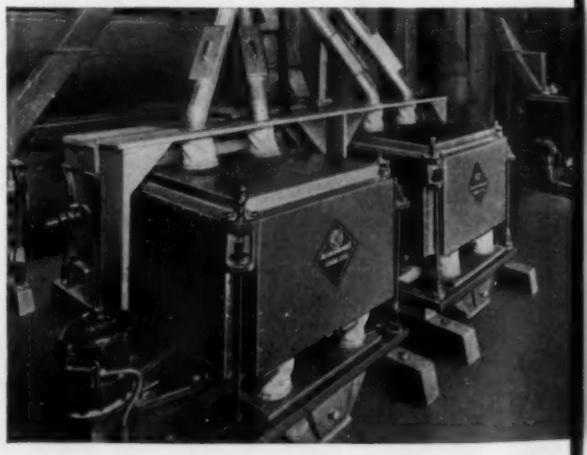

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CHEMICAL & METALLURGICAL ENGINEERING
ESTABLISHED 1902

NOVEMBER 1939

S. D. KIRKPATRICK, *Editor*

# Recognition and Award

ABOUT THIS TIME each year our columns carry pleasant news of chemists and engineers who are to be honored for their outstanding contributions to science and industry. For all of us there is pleasure and satisfaction in seeing our friends publicly acclaimed for their brilliant achievements. In themselves the various medals and other forms of award are of little intrinsic value, yet the honors they bestow are of great and lasting importance.

Presentation of the Edward Goodrich Acheson medal to Francis C. Frary, the Chemical Industry medal to Robert E. Wilson, the Nicholls medal to John M. Nelson, the Chandler medal to Thomas H. Chilton and, in January, the Perkin medal to Charles M. A. Stine—are all well deserved tributes to men of great talents and ability. They are cited for a variety of accomplishments in their different fields. As plainly shown in their speeches of acceptance, these men are the first to acknowledge—in fact to insist—that they receive their medals not as individuals, but rather as representatives of organizations, of groups of fellow workers who made possible their achievements.

It was to recognize this organization or group attainment that *Chem. & Met.* in 1933 established the Award for Chemical Engineering Achievement. Our profession, perhaps more than any other, has reason to know that industrial advances are made by the cooperative and coordinated efforts of many individuals. The brilliant discoveries of the research laboratory must be translated into efficient production and profitable sale. The steps in that process are seldom as spectacular as the original research, but unless very practical difficulties are surmounted (quite often by chemical engineers) there is not likely to be any medal presentation.

In this translation of the brilliant research into the successful plant process, one important factor is too often overlooked. The manufacturer of chemical engineering equipment, who works patiently with a company's own engineers in developing a new product or process, usually contributes considerably more than he is paid for. He, too, spends money for research and development. The equipment he sells is not just so much metal, glass or rubber, but is an engineering service based on practice as well as theory. In rendering that service to a wide field, the equipment manufacturer is a potent force in the spread of technology from one industry to another. Chemical engineering owes a great debt, for example, to those who originally developed their equipment for mechanical, mining and metallurgical applications.

It has been suggested that that debt might be paid, in part at least, by the establishment of a separate award to the manufacturer or designer of chemical engineering equipment who has contributed the greatest advance during the biennial intervals between the National Expositions of the Chemical Industries. One hesitates to add to the present multiplicity of medals and awards but this does appear to be a form of group recognition quite worthy of a place in our profession. May we have your views on how it should be organized and by whom it should be sponsored?

# THEN *and* NOW

## 1914 - 1939

**Twenty-five years ago** there was much burning of midnight oil in the library of the Chemists' Club in New York. Serious-minded young men were poring over old German tomes intent on finding out how to make this or that chemical for which the European war had suddenly cut off the foreign supply. All too frequently these library researches were interrupted by urgent requests for information about the availability of raw materials, laboratory supplies and plant equipment. Almost in self defense, the volunteer librarians drew up lists of the new companies that were springing up to supply the growing needs of our infant chemical industry.

Then someone had a bright idea. Wouldn't it be a fine thing for everyone if all these chemical interests could be brought together in one place to match their wares and needs? What a chance this would be to show what the American chemical industry was trying to accomplish and the raw materials and equipment that were needed if it were to grow and prosper!

That was the historic background from which developed the first National Exposition of the Chemical Industries, held in Grand Central Palace in New York, during the week of September 20, 1915. It dramatized the beginning of our industrial progress by bringing together for the first time the combination of men, materials and machinery that were essential for building a great chemical industry in this country.

Now, almost a quarter of a century later, we are to have the 17th Chemical Exposition, again in Grand Central Palace. And despite the tremendous progress made by chemical industry and the chemical engineering profession since 1914, certain conditions are strangely similar. Again much of Europe is at war. Again people are asking what effect cessation of imports will have on American industry. Again there is a great stimulus to develop new products or to expand production to supply new markets at home and abroad. Again we see renewed interest in the tools and equipment needed for still greater advance.

The similarity might be extended to draw some worthwhile conclusions about the effect of chaotic bidding up of prices for labor and materials, and about the inevitable collapse that must follow an inflationary war boom. But the look back to 1914–15 can serve an equally constructive purpose if we use it to measure trends and gage the direction of our further progress. Elsewhere in the November issue of *Chem. & Met.* are approximately twenty interesting summaries of "Then and Now in Plant Operation." Each is written by a chemical engineer who has been intimately concerned with the production problems of the industry or process under discussion. As these men recall the many changes that have been made in chemical engineering equipment since the first Chemical Exposition in 1915, they unconsciously chart a new course for even greater improvements. They give direction and purpose to the advances of the unit operations and processes which are reflected in our preview of the new developments that will be seen by the thousands of chemical engineers and industrialists who will visit Grand Central Palace during the week of December 4.

With this in mind, remember that this is your show! Make the most of your great opportunity to see and study the things that will help you most in your job. The 17th National Exposition of Chemical Industries is your chance to draw heavily on the experience of several hundred companies that in turn have brought together the best equipment and processes used by literally thousands of other companies in the chemical process industries. A few hours spent in such company will help you to make sure that as we go into the next twenty-five years, we take full advantage of all the lessons we have learned since 1914.

# Chemical Engineering Marches On

THE CHEMICAL ENGINEER came out of the World War in 1918, a strong and lusty youngster. He had been through his baptism of fire and had proved his right to a place in the ranks alongside of the veterans of mechanical, civil, electrical and mining engineering. In four years he had helped his country to develop its own chemical industries in order that we might have the basic chemical products for which we once depended on foreign sources. Simultaneously he had laid the basis for a great new profession.

In the twenty years since then, chemical engineering has steadily grown in strength and influence. In most educational institutions, under-graduate enrollment is second only to mechanical engineering. It leads all others in post-graduate training. As chemical industry has recognized the broad, as well as fundamental, character of chemical engineering education, it has recruited more and more of its new personnel from men of this training.

At first there was a tendency to regard the chemical engineer as a technical specialist—confining him solely to the single function he performs so well, namely, the translation of laboratory research into large-scale and profitable production. Control of manufacturing was still in the hands of the so-called " practical man ". Control of sales and most other administrative functions were dominated by the " business man ". But as the forward-march of chemical engineering continued, there came new opportunities, even in the face of adversity.

The depression brought with it a wholesome change in attitude toward anything or anybody that could contribute to increased efficiency. Operating economies and improved processes were the first line of attack, and one that could often be led most effectively by chemical engineers. As markets continued to decline, there was a shift in emphasis to new products and processes—again a chemical engineering opportunity. As selling became more difficult by older methods, a few companies began experimenting with technical service and customer research, drawing their personnel largely from their development departments.

To encourage this "broader participation by the chemical engineer in the affairs of the process industries," *Chemical & Metallurgical Engineering* in 1933 conceived the idea of a unique award for chemical engineering achievement. In contrast with most medals and other forms of recognition, this award was to go to a *company* rather than to an individual. Thus it was to recognize group effort as symbolized by the type of achievement that results from the coordinated effort of an entire organization—of executive, engineering, research, production and

sales divisions. This award, therefore, served a double purpose of recognizing an outstanding group achievement and at the same time calling attention to those progressive companies that had encouraged their chemical engineers to participate broadly in all of the affairs of the process industries.

The first award in 1933 was made to Carbide & Carbon Chemicals Corp. for its signal achievement in developing a great synthetic, aliphatic chemical industry. Here was a typically American development growing out of American research and based on a great American resource—the hydrocarbons of petroleum and natural gas.

To the Organic Chemicals Department of E. I. duPont de Nemours & Co. went the 1935 award. Here again the achievement covered a broad range of developments best typified by the commercial production of two critical materials for which we once depended on foreign sources—synthetic rubber and synthetic camphor.

In 1937 Monsanto Chemical Co. completed a research and development program that resulted in the electric-furnace production of elemental phosphorus in tank-car quantities. Thus was laid the basis for an entirely new chemical industry utilizing this most remarkable of the chemical elements.

Last month, the Committee of award, which consists of nine recognized leaders of the chemical industry and the chemical profession, decided that the outstanding chemical engineering group achievement of the past two years was that of the Standard Oil Development Co. This productive and resourceful organization that had pioneered in the application of high-pressure hydrogenation and other catalytic methods in oil refining, is now to be honored for its distinguished work in developing processes for new aviation fuels and synthetic chemical products from petroleum.

Especially significant is the fact that this year's award is to go to a technical organization in the petroleum industry. In recent years that industry has been the largest single employer of chemical engineering graduates. Its processes have been almost revolutionized by the rapid advance of a new technology. Truly, chemical engineering marches on!

## THE COMMITTEE OF AWARD

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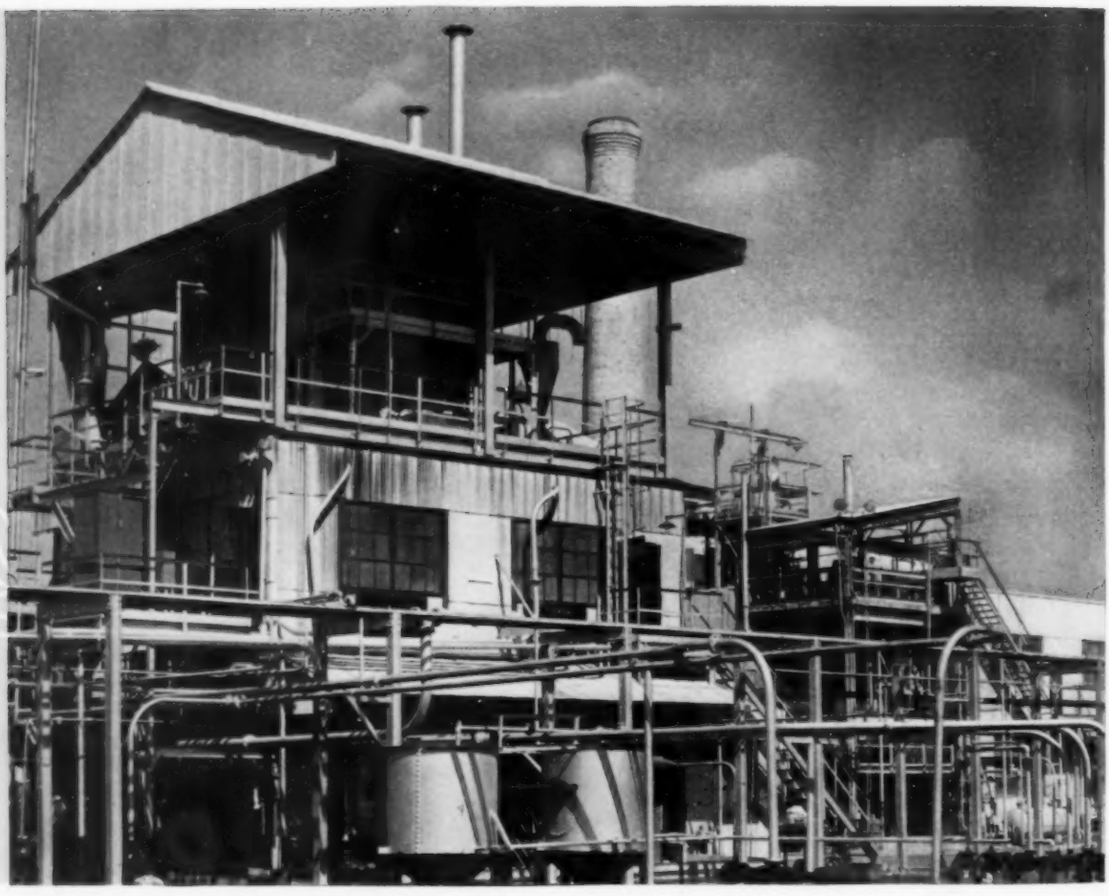
*Head, Department of Chemical and Metallurgical Engineering, University of Michigan. Past President, American Institute of Chemical Engineers.*

# Triumph of



**Catalysts are necessities in many of the newer petroleum processes. Here is a plant in which they are being made commercially at Baton Rouge.**

SIDNEY D. KIRKPATRICK

**Editor of** *Chemical & Metallurgical Engineering*

TWENTY YEARS AGO the Standard Oil Company (New Jersey) first established an independent technical department. Chemical engineering was then scarcely recognized by the petroleum industry, although the refiners were on speaking terms with its basic sciences of chemistry and physics. As a matter of fact, two of the earliest advisers to Mr. Frank A. Howard in his work of organizing Jersey's new technical department were the late Professor Ira Remsen of the chemistry department of Johns Hopkins and Dr. Robert A. Millikan, then professor of physics at the University of Chicago. Almost from the beginning, however, it became evident that the petroleum industry's most pressing problem was to apply intelligently and efficiently the basic scientific principles already known for many of its refining processes. Recalling earlier work of this kind in association with Professor Warren K. Lewis of Massachusetts Institute of Technology, Mr. Howard sought the consulting services of that energetic and resourceful chemical engineer — whom he credits with having been,

# a Technology

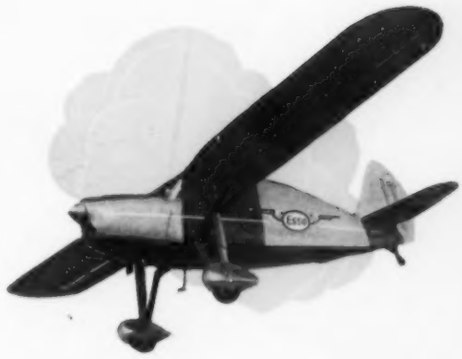
from that time up to the present day, the fountain head of inspiration for the chemical engineering achievements of the company. Then began, slowly at first, but soon gaining in momentum and influence, a new technology destined to revolutionize the petroleum industry.

Many important contributions have come from this progressive group that has since taken the corporate form of the Standard Oil Development Co. It is honored now for what it has accomplished during the past two years in developing new chemical engineering processes and equipment to make available millions of gallons of new super-fuels for aviation, as well as other valuable products synthesized from the hydrocarbons of petroleum.

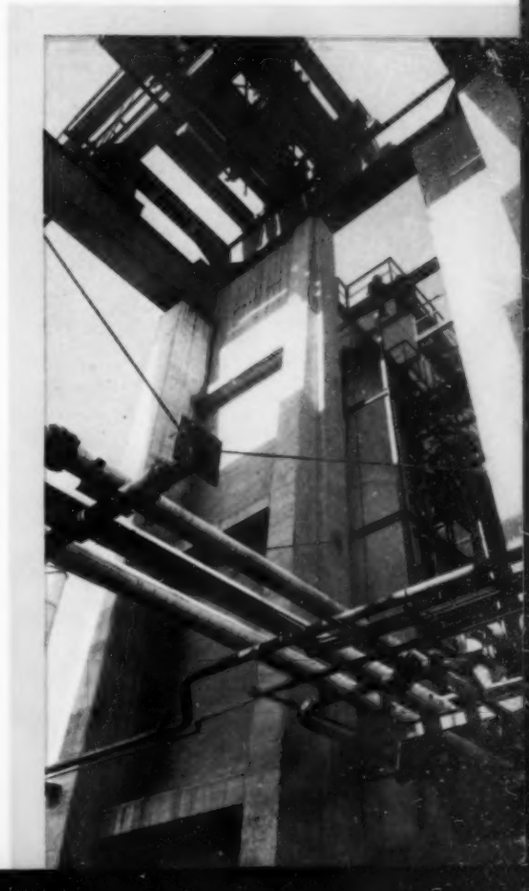
Ten years ago iso-octane, the arbitrary 100 in the anti-knock scale for rating motor fuels, was only a laboratory reagent and sold for about $30 a gallon. Today millions of gallons of this compound (or its fuel equivalent) are being bought by the aviation industry at one one-hundredth of the 1929 price. In 1937 the oil industry produced 7,000-000 gallons of 100-octane aviation gasoline. In 1938 the output had jumped to 20,000,000 gallons and by the end of 1940 it is estimated that most of the present 125,000,000-gallon aviation market will be supplied by these new super-fuels.

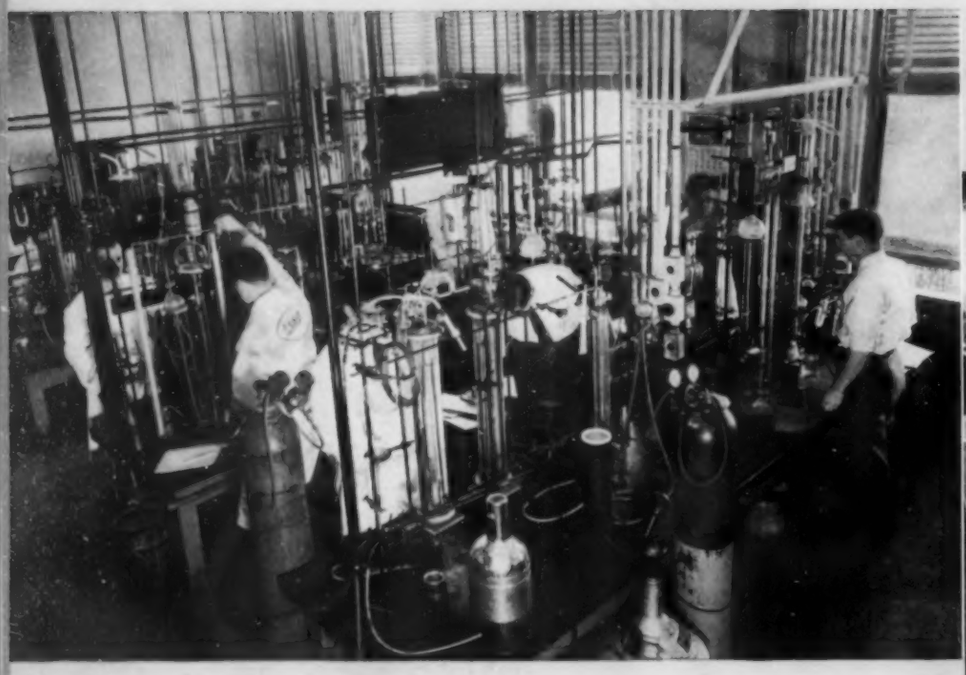
When used in modern high-compression engines, the 100-octane fuels will permit at least 25 per cent increase in power or about 12 to 15 per cent reduction in fuel consumption. This means safer take-off, faster climbing, greater speed and longer cruising radius. In the case of passenger and air mail services, the new gasolines permit of much greater payloads. Thus for a 1,400-mile flight an airliner that formerly used 87-octane fuel found it could get along better with 1,200 lb. less of 100-octane gasoline. As a result the plane could carry six more passengers or their equivalent in mail and freight. Such savings quickly run into millions of dollars in times of peace. And, in times of war, they are of inestimable value to the national defense.

Before describing the processes that have been developed to make these new fuels available, let us pick up the story of the Jersey company's technical department and briefly follow the history of its growth and development. Most attention in the early days was concentrated on the improvement of existing processes. Distillation equipment and technique gave the chemical engineer his first opportunity to apply sound scientific principles in efficient fractionation processes. Important economies were effected in substituting continuous in place of batch operations throughout the refineries and in conserving heat and energy through better designed equipment. Rational application of the basic time-temperature law to the cracking of heavy oil resulted in the development of the continuous tube and tank process as a substitute for the batch stills of the pioneer Burton process. Vacuum distillation and highly developed forms of flash distillation equipment replaced the wasteful steam stills. The olefinic gases from the cracking stills were converted into isopropyl and higher alcohols and the foundation was thus laid for producing chemical derivatives from petroleum.



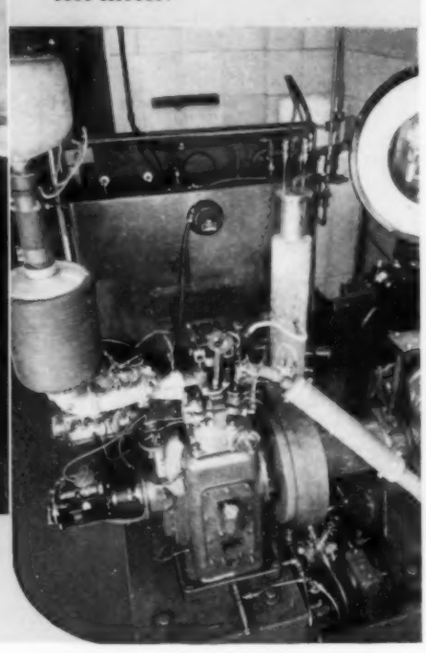
**That man may fly with greater speed and safety, new synthetic fuels, produced in high-pressure hydrogenation plants such as that shown below, are constantly being tested in a fleet of "flying laboratories."**





**Gas analysis laboratories at Linden, N. J. are constantly testing purity and composition of the hydrocarbon raw materials from which new fuels are synthesized.**

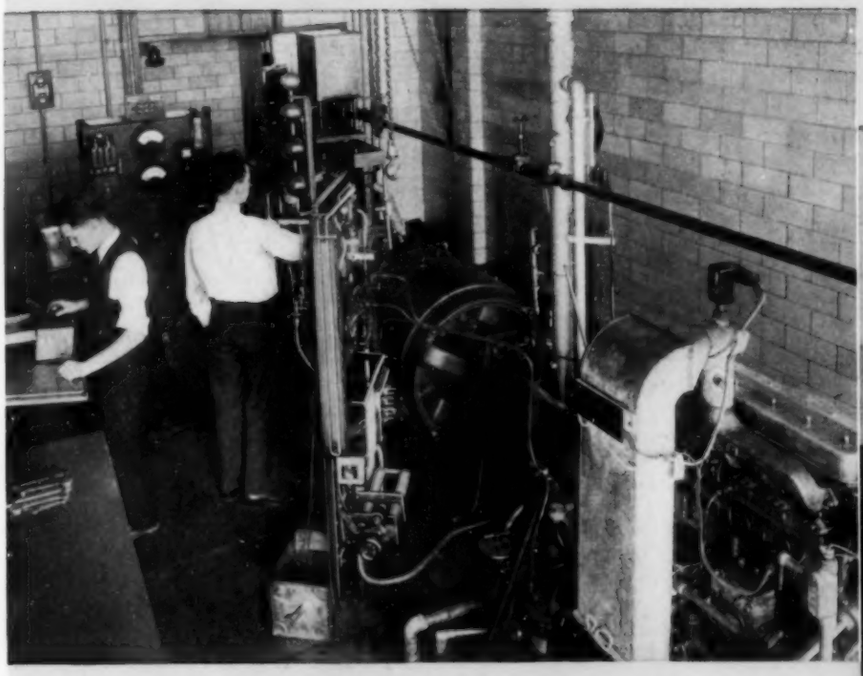
**Equally important are engine tests on the finished products as in this super-charged aviation test motor.**



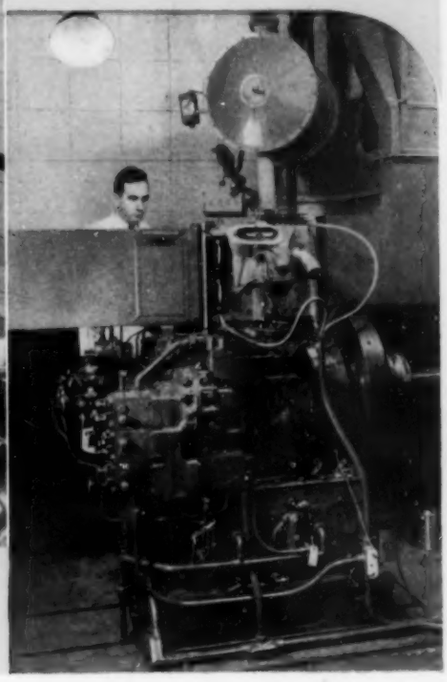
About 1924 a new trend began to develop with the advent of tetraethyl lead and its application in anti-knock motor fuels. Standard Oil Co. (N. J.) had been engaged in a race with General Motors to solve the anti-knock problem — a race which was won by Midgley's discovery of the remarkable properties of tetraethyl lead. Not discouraged, however, the Standard group turned to the secondary problem of producing this rare chemical by a cheap and efficient process. Here their efforts were crowned with early success. Professor C. A. Kraus, then of Clark University and a foremost expert on metallo-organic compounds, was retained by the Standard Oil Co. (N. J.) and with the support of this organization set up a special laboratory in which he devised and developed the ethyl chloride process for tetraethyl lead manufacture. This accomplished, Standard joined forces with General Motors and organized the Ethyl Gasoline Corp. which has become a basic factor in the oil industry and one of America's leading chemical manufacturers.

The next important chemical engineering development came with the pioneering application of high-pressure hydrogenation in petroleum refining. Despite the fact that the original process, as applied to coal, was of German origin, major credit must go to the Standard Oil Development Co. for its successful adaptation to petroleum. Negotiations were begun in 1925 and early in 1927 an agreement was reached with the owners of the Bergius, Pier and related patents. Shortly thereafter a hydrogenation laboratory was established at Baton Rouge to study this process under American conditions.

Professors Robert T. Haslam and Robert P. Russell of the chemical engineering department at Massachusetts Institute of Technology were given the responsibility of organizing and staffing this laboratory. They selected from their graduate students and associates fourteen other young chemical engineers, all well trained in their profession, but no one of them thoroughly experienced in petroleum technology. Today eleven of the original fourteen are still in the employ of the Standard Oil Co. (N. J.), in a wide variety of responsibilities scattered throughout the entire world. For one (the late Dr. William V. Hanks) a promising executive career was suddenly ended in 1937 with his death as a result of an appendectomy. Two others have left the company, but are still employed in technical work. The careers of the group as a whole may be regarded as typical of those of hundreds of other technical men who have found an opportunity



This C. U. E. test engine utilizes a single cylinder taken directly from an aircraft motor.



**As light-weight diesels become more important, the petroleum industry must study their fuel and lubricant requirements. Here are two undergoing dynamometer tests.**

to grow and develop in a large organization such as the Standard Oil Development Co.

In the course of less than three years the original group at Baton Rouge demonstrated, first in a high pressure laboratory and later in a pilot plant, that by controlling the conditions of hydrogenation in the presence of the proper catalysts, the process could be used to effect almost any desired change in the physical or chemical characteristics of practically all petroleum products.

Thus it became possible to convert low-grade refinery residua into marketable gasoline, to produce high yields of exceptionally high anti-knock motor fuels without attendant formation of fuel oil, to improve the quality of kerosene and burning oil, to manufacture lubricants comparable or superior to the best obtainable from existing sources and to make petroleum solvents having far greater solvency than any formerly available.

On the basis of the experimental results obtained at Baton Rouge, large-scale hydrogenation plants were built in Bayway, N. J., and Baton Rouge, La. In their design and construction they represented some of the finest examples of modern chemical engineering practice in the new and important field of high-pressure technique. They are of most

**Esso's Beechcraft plane stationed at Curtiss-Wright Field in Caldwell, N. J., is readily available for fuel testing.**

current interest now, however, because of their use in the production of aviation gasoline. The hydrogenation unit at Baton Rouge is today the world's largest plant engaged strictly in aviation gasoline service, with the possible exception of Germany's.

The position of the Standard Oil Development Co. in the petroleum industry is a unique example of an efficient corporate organization based on co-operative research. It is engaged exclusively in technical activities relating to the oil industry for which a staff of over 1,500 men are on its direct payroll. Indirectly, through its arrangements with affiliated companies, it also supports and coordinates other large technical staffs and facilities. Its business rests on agreements with the principal refining units of the Standard Oil Company (N. J.) group throughout the world by which it carries on the major research and development activities in which the refineries are interested. Sharing the cost of these activities results in material economies by avoiding unnecessary duplication of staffs and laboratories. But at the same time, this arrangement has permitted the building up and maintenance of much more comprehensive research facilities than would have been possible had each refinery unit proceeded independently.

The major laboratories in which the research and development program is carried out or coordinated by the Standard Oil Development Co. are located in Linden, N. J. (Esso Laboratories), in Baton Rouge, La., and in London, England. The extensive facilities in New Jersey include a number of engine laboratories where fuel and lubrication tests are made on automotive, aviation and diesel engines. In the process engineering division, pilot plants are used for studying new developments under conditions simulating refinery operations.

**Experimental fractionating tower in Bayway N. J. process development laboratories.**

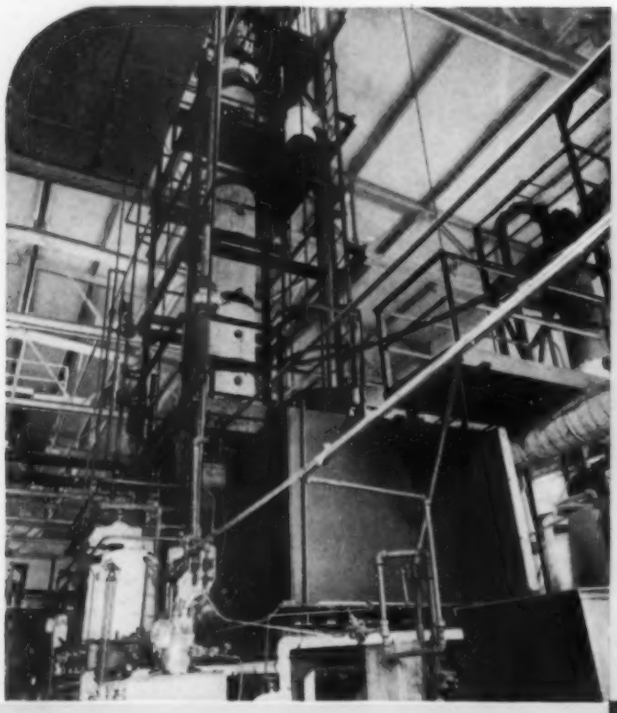
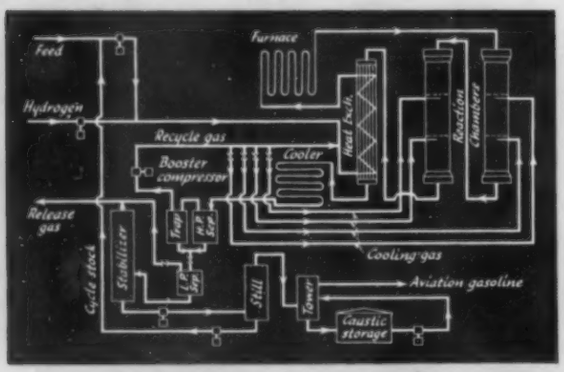


**Fig. 1. Flow sheet for naphtha production by hydrogenation process.**



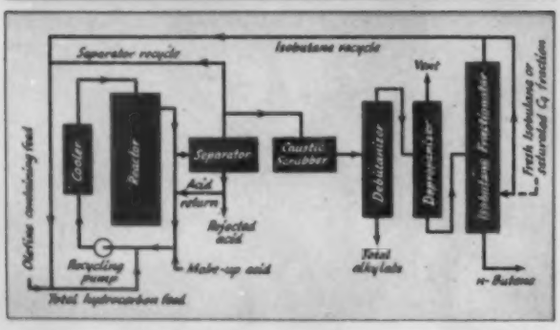
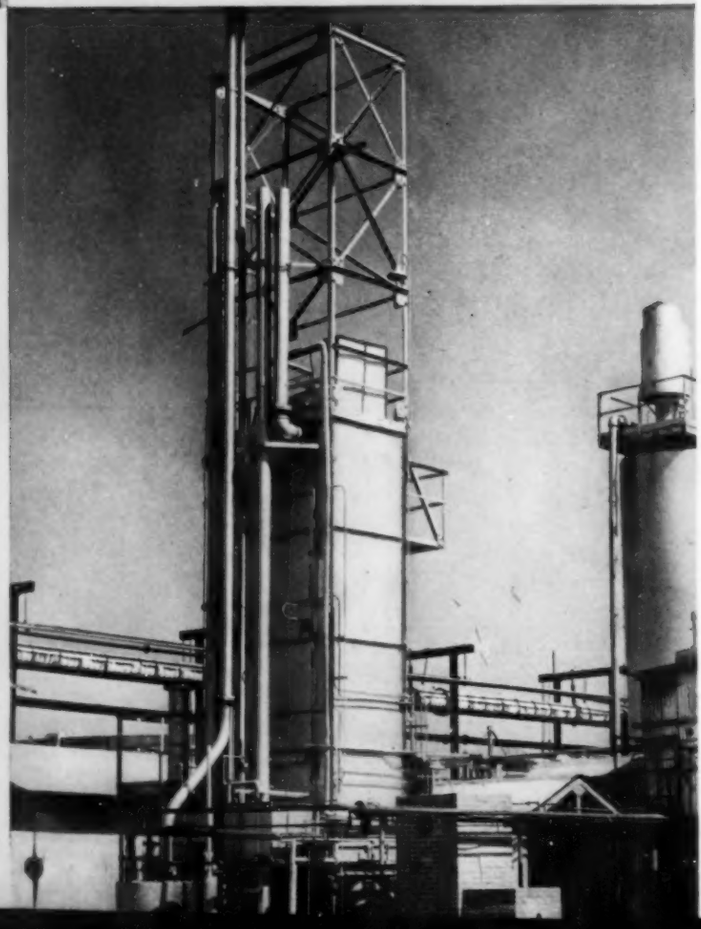




**Fig. 2. Simplified flow diagram for alkylation process for producing aviation napthas.**

**Pilot plant at Baton Rouge for studying hydrogen production and dehydrogenation process.**



**Pilot plant at Baton Rouge where new catalytic refining methods are studied under conditions simulating full-scale operations. This plant has a capacity of 100 bbl. per day.**

At Baton Rouge a catalyst testing and research laboratory works in close cooperation with the commercial plant for manufacturing these necessities for modern processes. In fact, it is fair to say that during the last few years the primary emphasis of the research and chemical engineering work of the Development Company has been in the direction of the various catalytic refining methods. These processes, of which hydrogenation is but one of the more highly developed, are chiefly concerned in changing the structure of the hydrocarbon molecules, either with or without change in size. They therefore approach so closely the processes of organic chemical synthesis that the modern trend of petroleum refining is distinctly toward chemical manufacture. The new aviation fuels are excellent examples of what can be done when chemical engineers start playing with millions of gallons of hydrocarbon molecules.

The branched chain paraffin molecules seem to be the ones that are most valuable in aviation fuels. Straight chain saturated hydrocarbons are proverbially bad knockers while the unsaturated olefins lack stability and are inclined to be gum-formers. One method of attack in building up the new synthetic fuels has been to take the lower olefin hydrocarbons in the $C_3$ and $C_4$ range, which are normally gaseous and too volatile for gasoline, and to convert them into larger molecules or polymers which can then be hydrogenated to give a saturated fuel. Another method is to take the lighter isomeric hydrocarbon molecules of the paraffin series and couple them directly with olefin molecules, again producing a branched chain paraffin or saturated fuel. This latter process of coupling molecules has come to be known as *alkylation*, while the other method is generally called *hydrogenation* although it involves polymeri-

New ethyl-chloride plant at Baton Rouge, designed and built for Ethyl Gasoline Corporation.

Corner of Humble's alkylation plant at Baton, Tex., showing huge fractionating towers for light hydrocarbons.

zation as well. Standard Oil Development Co. has had a pioneering role in both processes as they have been developed commercially to produce aviation fuels.

Up until recently all aviation gasolines came from the light fractions or naphthas obtained from a limited number of crude oils that would give straight-run gasolines of about 72 to 74 octane rating. The anti-knock properties of such naphthas could then be raised to 87-octane by the addition of tetraethyl lead and the resulting fuel would have the stability and volatility desired for aviation uses. Unfortunately, such selected naphthas are available in only limited quantities. However, the earlier work at Baton Rouge had demonstrated that with high-pressure hydrogenation it would be possible to produce synthetic naphthas that were similar in volatility and stability to those from the selected crude oils and were actually superior to the natural naphthas in anti-knock properties. A series of extremely active hydrogenation catalysts were developed and are being employed extensively for converting gas oil feed stock into the base stocks used in premium-grade aviation fuels of 100-octane number (or even higher). These new catalysts have been kept in continuous operation for more than a year on a commercial scale. They are of strong mechanical structure and immune to sulphur poisoning. A flow sheet of the process of producing these synthetic aviation naphthas by high-pressure hydrogenation is shown in Fig. 1.

A second and most interesting application of hydrogenation is for producing high octane number blending agents for use in 100-octane aviation gasoline. In this process, synthetic polymers made by the co-polymerization of iso- and normal butylenes are hydrogenated to yield branched chain compounds of highly desirable qualities. Prior to hydrogenation, these polymers would show octane ratings of 82-84 and would not respond

In these concrete stalls are the catalytic converters in which aviation naphthas are produced by high pressure hydrogenation.

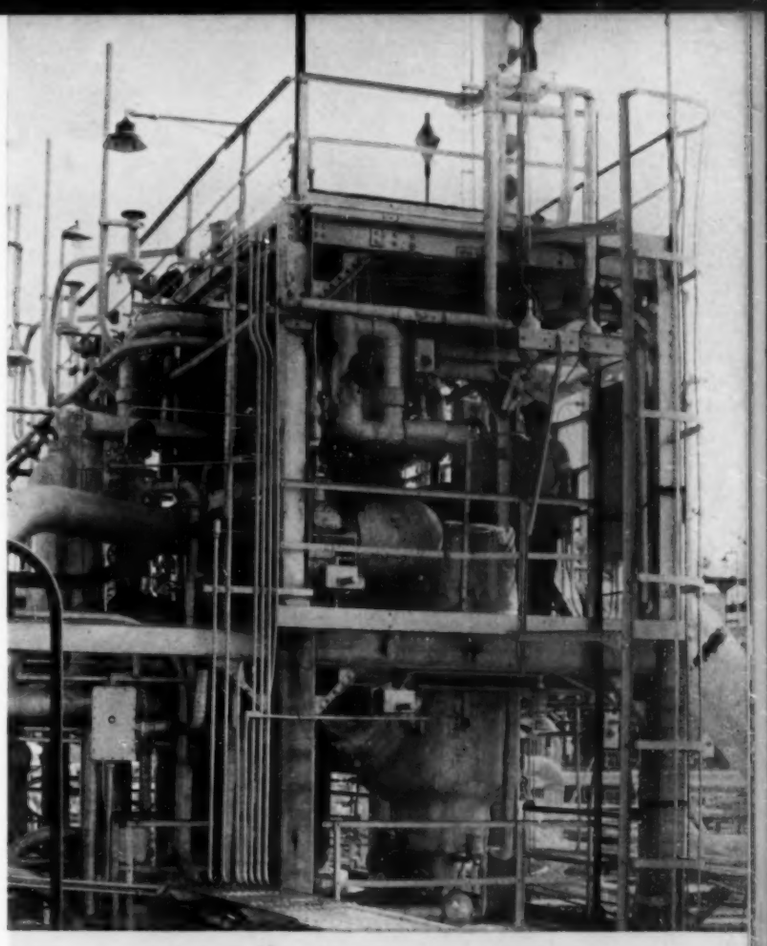
readily to the addition of tetraethyl lead. After hydrogenation, the octane ratings will jump to 97–100 and they are much more susceptible to lead treatment. Hence these products are desirable as blending agents, although not serviceable as aviation fuels in themselves because they do not have the proper boiling range. A different type of catalyst is used in this hydrogenation process, which is carried out at somewhat lower pressures than in the case of naphtha production. Again the experience at Baton Rouge has shown that the catalysts will stand up under continuous operation for at least a year.

The high-pressure hydrogenation process developed by the Standard Oil Development Co. for the manufacture of iso-octane by hydrogenating polymers has been generally adopted throughout the industry. It is used today by the Anglo-Iranian Oil Co., Gulf Oil Co., Standard Oil Co. of California, Standard Oil Co. of Indiana and the Shell interests in Holland and England.

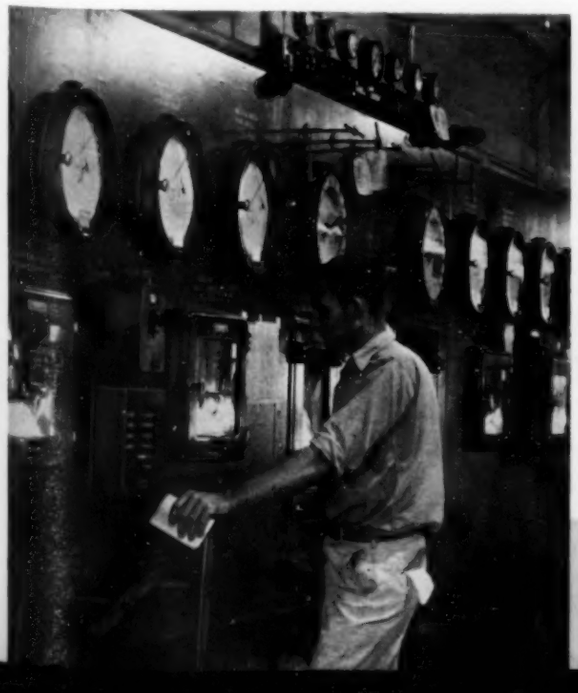
A third and still newer off-shoot of hydrogenation is the so-called hydro-forming process developed cooperatively by the Standard Oil Development Co., the M. W. Kellogg Co., I. G. Farbenindustrie A. G. and the Standard Oil Co. of Indiana. For the first time this makes possible the production of high grade aviation gasoline base stocks from low octane number naphthas. It is an operation of major importance from the standpoint of the national defense. It can be used to supplant the ordinary thermal process of reforming for motor gasoline production and any plants installed for that purpose in peace-time are potential producers of aviation gasoline in case of war. The first commercial plant to utilize this process will shortly go into operation at Bayway, N. J. and a number of additional plants are under design or construction.

The present commercial process of alkylation, in which sulphuric acid is the coupling catalyst, was developed through the combined efforts of the Anglo-Iranian, Humble Oil, Shell Development, Standard Oil Development and Texas research staffs. Working independently, these groups had each accomplished important technical advances contributing to essentially the same purpose. So, in the best interests of the petroleum industry as a whole, and in order to speed the development of a major new source for high-octane aviation fuels. these companies combined their efforts and have just presented the operating results of their work in a joint paper before the November, 1939, meeting of the American Petroleum Institute. Fig. 2, which is taken from that publication, is a simplified flow diagram showing the essential features of the alkylation process.

Almost a year before this cooperative arrangement was completed, the research and development organization of Humble Oil and Refining Co., working with the Standard Oil Development Co., put into operation a large commercial alkylation unit at Baytown, Texas, that produces 1,200 bbl. per day of alkylate. This plant is still the largest commercial unit in operation although the A.P.I.



**Another view of 100 bbl. pilot plant for studying catalytic cracking of petroleum.**



**Control of many process variables centers in this operating panel in the hydrogenation plant.**

paper lists five others of equal or larger capacity which are already under design or construction.

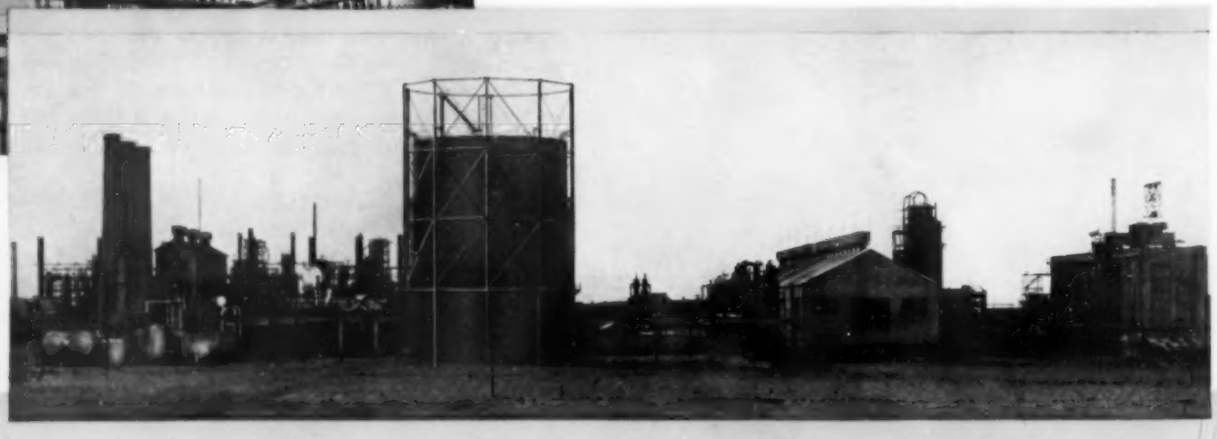
With the advent of sulphuric-acid alkylation, isobutane was required in excess of the amounts normally available. To meet this need the Standard Oil Development Co. has worked out an isomerization process for converting normal butane into isobutane. The process was operated successfully for a considerable period on pilot-plant scale and a large commercial unit is now approaching completion. As far as is known to the writer, this is the only commercial isomerization unit thus far under construction. An interesting feature of the process is that the same operation and equipment can be used to convert normal pentane into isopentane. The latter is a very valuable ingredient for high octane aviation fuels.

Not all of the recent activities or achievements of the Standard Oil Development Co. can possibly be discussed in this brief summary. It would be patently unfair, however, not to mention a few other developments that reflect the wide field of interest in which this organization works. For example, a new process for the production of ethyl chloride was developed and a large plant to utilize this technique was built in Baton Rouge, La. late in 1938 for the Ethyl Gasoline Corporation. This plant is capable of producing 20,000,000 lb. per year of ethyl chloride.

The Standard Oil Development Co. has been particularly successful in producing addition agents for lubricating oils and has perfected a variety of pour depressants, viscosity index improvers, oiliness agents and oxidation inhibitors. Reference has already been made to the solvents which have been so important in the rapid advance of the synthetic resin and lacquer industries. Various polymers of high molecular weight are now finding important uses as plastics and rubber substitutes. Thus advances have been made on a wide front of organic chemical developments relating to the oil industry.

Important researches now under way in the company's laboratories are destined to carry all of these developments far forward and in many directions which no one can now foresee. But it is certain that the progress of such a productive group will continue to gain momentum and influence as it succeeds in guiding a new and creative technology to greater and greater achievements.

**This gasoline stabilization plant at Bayway, N. J. yields hydrocarbon fractions for fuel and chemical syntheses**

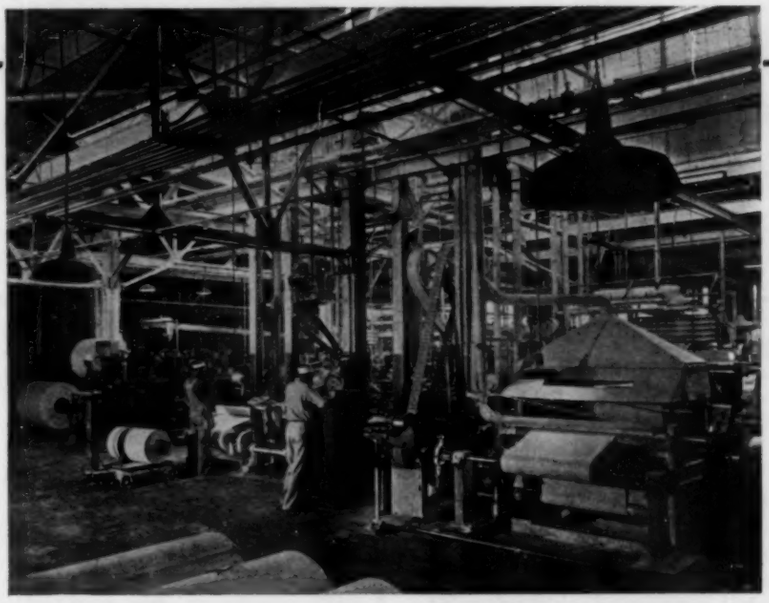


**General view of petroleum hydrogenation plant of Standard Oil Co. of Louisiana at Baton Rouge.**

# Advances on Many Fronts

*Recent achievements of a pulp and paper company, a manufacturer of equipment, a producer of new synthetic fiber, a metallurgical plant and two heavy chemical industries are cited as typical advances of chemical engineering.*

*Editor's Note: Presented this year for the consideration of the Committee of Award for Chemical Engineering Achievement, was a series of brief memoranda, outlining the progress that has been made since 1937 by approximately 20 companies in the process industries. These included small as well as large companies in a wide variety of fields. As indicative of the nature and scope of these developments, we have selected six typical achievements that point the direction in which chemical engineering has made some of its most important advances.*



**In the field of packaging, physical and chemical combinations of certain substances have produced compositions making possible new sheet materials**

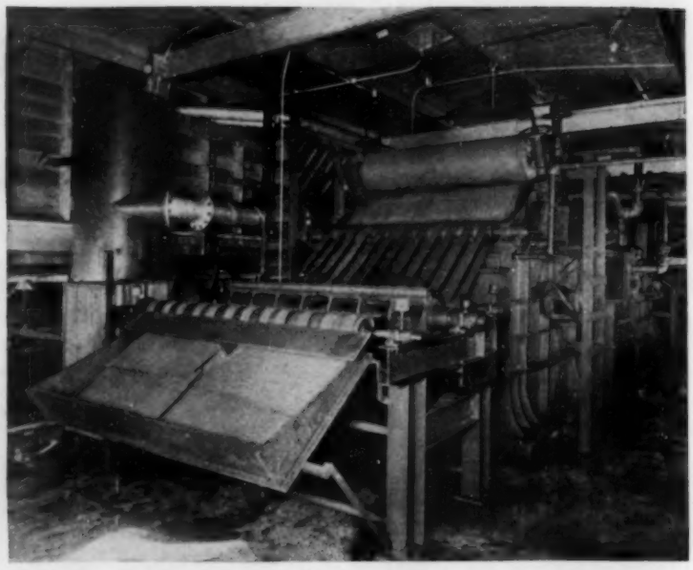
## Pulp and Paper

IN THE PAST few years the pulp and paper industry has probably made as much outstanding progress in the application of chemical engineering methods and processes as any other industry outside of the strictly chemical field. In the opinion of many well-informed people in the pulp and paper industry, the Marathon Paper Mills Co. with plants at Ashland, Menasha, Milwaukee, Wausau and Rothschild, Wis., has played a leading rôle in subjecting its operations to a high degree of engineering research and control. This policy has resulted in the development of a number of new products that have contributed basic improvements in food packaging. It has also uncoveved and partially developed a new chemical raw material—lignin—which may well rank as one of the most important of our future chemical resources. Lignin is already the source of more than one-third of the vanillin production of the United States and various lignin salts for tanning and other uses are now in commercial production. New lignin plastics for laminating and molding compositions are being made. Special lignin resins and a wide variety of other derivatives are coming along in laboratory or pilot plant stages. Thus a whole new chemical industry is being built successfully on a waste product so abundantly available as to create stream pollution problems in many parts of the United States.

In the field of packaging, physical and chemical combinations of certain substances have produced hot-melt compositions making possible new sheet materials. One such combination of materials resulted in a flexible, thermoplastic, water- and moisture-proof composition. This may be cast into a self-sustaining film in which case it is known as Parafilm. Coated onto other sheet materials, to make moisture-proof sheets of high heat-sealing strength, it is known as Parakote. Employed as a laminating medium to produce sheet materials of high moisture-proofness, yet suitable for use on ordinary packaging machines, it is called Paraply. All of these products have received wide commercial acceptance in the food packaging field.

The idea has been followed that the correct procedure in manufacturing pulp into paper requires a thorough knowledge of the user's requirements of the paper; suitable specifications for raw materials and finished products, predicated on use requirements; standardized testing methods and operating control. Grades of paper have then been developed for particular uses—strong papers for operation on fast machines; papers of low water vapor permeability for products affected by humidity changes; wrappings which give visibility and yet re-

Rotary digester in the lignin plastics plant of the Marathon Chemical Co.



Lapping machine. Products include: sheet for laminating and molding compositions and resins for coating and impregnating

tard the adverse action of ultra-violet light.

As a pioneer in the field of lacquered paper, Marathon has brought out heat-sealing sheets which represent the highest moisture-proofness yet attained in fibrous packaging materials.

From the standpoint of chemical industry, one of the most interesting chemical engineering achievements of Marathon has been its work on the disposal and utilization of waste sulphite liquor resulting from the manufacture of pulp. The major objective of this work was to supplement the value of the cellulose pulp by realizing on the commercial potentialities of the large tonnage of non-cellulose organic materials in such liquors. A further incentive to such utilization was to reduce the stream pollution incident to discharging these waste liquors into waterways.

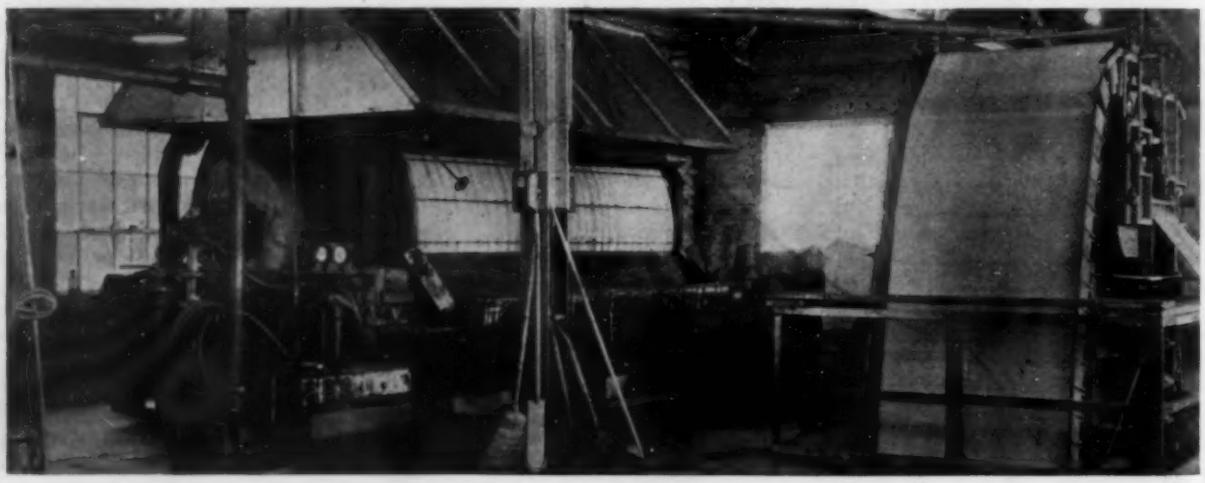
The basic calcium lignin sulphonate recovered as the organic product and called "OP" constitutes the new lignin raw material. It is comparable with coal in many of its chemical potentialities and has already found various uses both with and without further processing. It lends itself to the procedures of organic synthesis and to inorganic modifications.

The lignin organic product (OP) without further processing other than merely drying and grinding, is now being used in carload lots for various purposes.

Vanillin is now being made from this lignin raw material by an alkaline hydrolysis of the OP product followed by solvent extraction and purification of the vanillin. The excellent quality of the lignin vanillin has been fully established and accepted by the consuming trade.

The spent effluent liquor from the vanillin operation is being processed to make plastic products, such as core and surface sheets for laminating and

Rotary vacuum filter on which lignin product is recovered as filter cake for delivery by screw pump through pipe to left—for processing into various lignin products or through pipe to right into tractor type press for dewartering



molding compositions and special lignin resins for coating and impregnating. Of these the lignin laminating sheets are in commercial production and the molding compositions and special lignin resins are in semi-commercial operation at present.

The basic calcium lignin sulphonate can also be converted by inorganic modifications into a complete series of lignin sulphonate salts and into the free lignin sulphonic acid. Of these, the magnesium, calcium and sodium salts are now being made and sold in tonnage quantities for tanning leather in boiler water treatment, as grinding aids, as dispersing agents and for various other purposes.

## Unit Operations Keep Pace

So many spectacular developments in chemical engineering processes have been made in recent years that we can easily lose sight of the equally important developments in unit operations which have made this progress possible. Inquiries into the research activities of some of the companies manufacturing chemical engineering equipment, such as Charles Roth reports elsewhere in this issue, reveal many advances in the technique of the unit operations.

Take, for instance, the Dorr Co., which largely concentrates its research on sedimentation, agitation, classification, and a number of other unit operations involved in solid-liquid handling. Throughout the world in general and from the company's research laboratories at Westport Mill in Connecticut in particular, have come many significant developments.

Among the prominent accomplishments since 1937 in the field of solid-liquid handling are these:

1. *Cement Rock Benefication*—The mechanical processing features of the Breerwood process were developed through the laboratory and pilot-plant stage and successfully applied to practice in four portland cement plants. (See *Chem. & Met.*, Feb. 1935, p. 68, for outline of the original process). Also two new plants are now being built for the National Cement Co. in Pennsylvania and for the Permanente Co. in California.

2. *Continuous Recausticization*—Continuous lime slaking has been an important factor in the design and construction of an advanced type of recausticizing equipment for the sulphate pulp mill of Hollingswood & Whitney at Mobile, Ala. Stainless steel construction and automatic control were important adjuncts to the new plant.

3. *Catalyst Preparation for the Houdry Process*—In making a catalyst for converting oil into gasoline by the new Houdry cracking process, it was necessary to develop a base-exchange procedure involving the replacement of the sodium radical with ammonia. This involved eleven stages of continuous decantation (an all-time record!) in two series of connected special washing thickeners.

4. *Chemicals from the Sea*—The application of thickeners and agitators to make magnesia products from brine and oyster shells by the Westvaco Chlorine Products Corp. process at Newark, Calif. was a unique chemical engineering achievement. (See *Chem. & Met.*, Sept. 1938, p. 478).

5. *Brine Purification*—For the West Virginia Pulp & Paper Co. at Covington, Va., a complete continuous and automatic process for the purification of brine for the manufacture of electrolytic caustic soda, was developed.

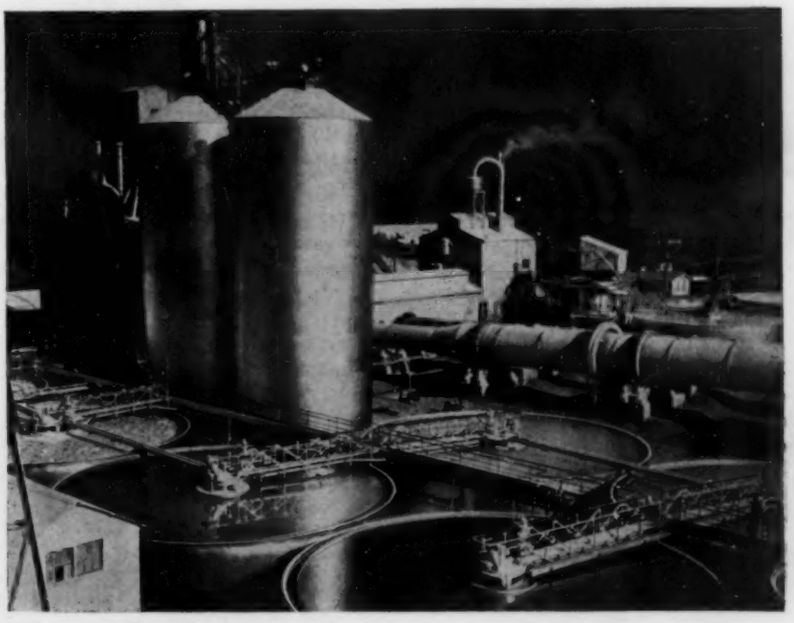
6. *Water Purification*—Complete and continuous plants for removing color and turbidity from raw river water, were built for Shell Oil, Bergstrom Paper, Escanaba Paper, Monroe Paper, and Marathon Paper. These plants permitted the use of water for processing, chemical mixing, flocculation and sedimentation, are all tied together in a single compact unit.

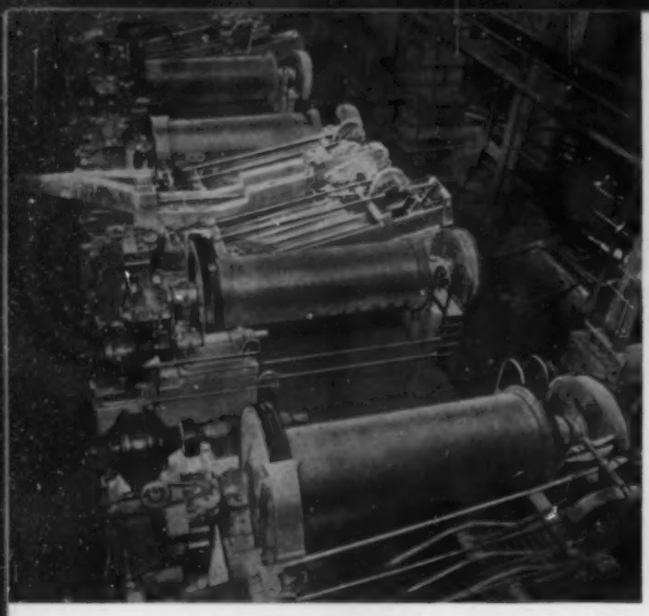
7. *Simple Purifying of Clay*—The usual practice in purifying clay is to repulp the clay to 100 to 1 dilution to permit sand and grit to drop out, then thicken, filter and dry. The newer process, by using dispersing and flocculating reagents, carries out the purifying with a pulp dilution of only 2 to 1.

8. *Sand Fractionation*—The unit operations of classification, hydroseparation and thickening were applied to the making of concrete sand for the Grand Coulee Dam in Washington (See *Chem. & Met.*, Sept. 1938, p. 494). The pit sand was fractionated into several closely sized fractions and recombined in proper proportion to give a final product of specified grain size distribution. Accurate chemical engineering methods were used to do this on an enormous scale—2,500 tons per hour.

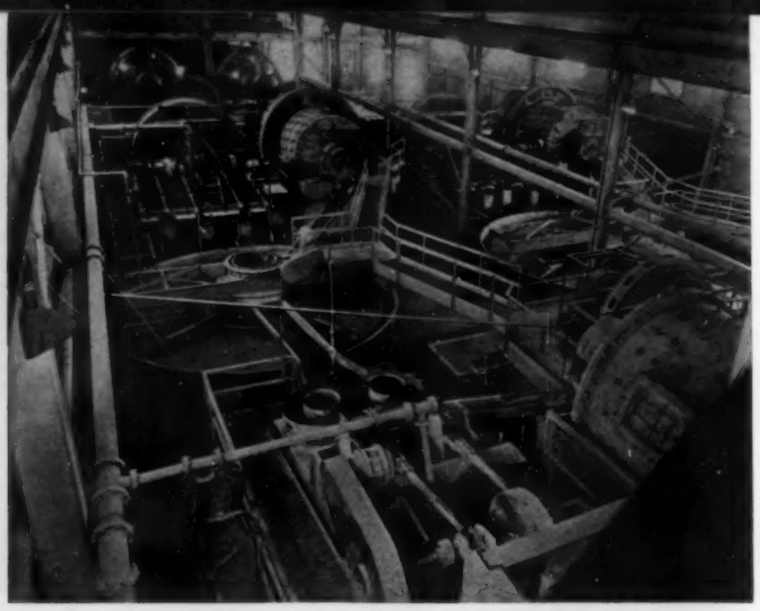
These recent developments, over such a wide variety of industries, become especially significant when

**6 single compartment thickeners used in production of magnesia products in Newark, Calif., plant of Westvaco Chlorine Products Co.**





Classifiers in closed circuit with tube mills at gold mines in Ontario



Rake and bowl classifiers in closed circuit with ball mills at wet process cement plant at Leeds, Ala.

viewed from the longer range objectives of the Dorr organization. Pioneer work in the fields of sedimentation and classification was first directed toward the problems of the mining and metallurgical industries. Gradually it became evident that such basic operations were common to the whole field of chemical engineering activity.

Thus one after another application developed and as research continued to explore and reveal new fields, important engineering developments followed. Covering most if not all the span of modern chemical engineering, the continuing achievements of the Dorr Company are stimulating proof of the progress that comes from chemical engineering research and development by the equipment manufacturer.

## Fabrics from Vinyl Polymers

THE LATEST PRODUCT arising from research on vinyl polymers is a textile yarn, Vinyon. This yarn possesses marked chemical inertness, and is available at the present time in such industrial fabrics as filtering cloths and in twines of a variety of constructions.

Vinyon synthetic resin fiber and yarn represents one of three separate and distinct types of vinyl polymerization products which Carbide and Carbon Chemicals Corp. has developed since 1927, when the vinyl polymers were first produced commercially. Their first application was for molded plastic products. A highly plasticized vinyl resin "sandwich filling" in a recently introduced safety glass represents the second type of these new products.

The third vinyl polymerization product—the yarn—begins as a white, fluffy powder. This product is a special grade of Vinylite resin, Series V, the copolymer of vinyl chloride and vinyl acetate. The American Viscose Corp. has been licensed to convert the powder to yarn. The yarn, in turn, is being woven into industrial fabrics by mills manufacturing textiles marketed by Wellington Sears Co.

Vinyon yarn is produced in two general forms, staple fiber and continuous filament. The latter is to be available in practically all deniers. It is a multifilament yarn, ordinarily with a filament denier considerably finer than silk. The yarn possesses a number of unusually good characteristics. Both yarn and fabrics are nonflammable and permanently water-resistant. The yarn can be produced at will with any tensile strength in the range of 1.0 to 4.0 g. per denier. Wet or dry, its tensile strength remains substantially the same. In addition, the yarn has a true elasticity comparable with silk—an unusual characteristic in a synthetic fiber.

Chemically the new yarn is relatively inert. At temperatures up to 150 deg. F., it is unaffected by mineral acids and alkalis except in high concentrations. It is dissolved by the lower ketones and certain halogenated hydrocarbons; it is swelled by ethers, esters and aromatic hydrocarbons; but it is unaffected by alcohols, glycols, or aliphatic hydrocarbons. It is not attacked by bacteria or fungi and will not support such growths.

Vinyon yarn is thermoplastic, a temperature of approximately 165 deg. F., being about the maximum that can be used without damage to the yarn. The "set" yarn, the type normally produced, is stable with respect to shrinkage up to the temperature of the set—usually 150 deg. F. In other words, there is no appreciable change in length of the yarn until its temperature exceeds 150 deg. F. Above the set temperature, however, shrinkage occurs, the yarn contracting in length a consistent amount for each temperature range. The shrinkage is accompanied by a slight reduction in tensile strength and a corresponding increase in elongation. Because the yarn becomes tacky at temperatures in the neighborhood of 300 deg. F., it is useful as a bond in composite fabrics.

**Comparative Yarn Tensile Strengths**

| Yarn | Dry (Relative Humidity—65%) Tenacity, g. per den. | Dry (Relative Humidity—65%) Elongation, % | Wet (Complete Immersion) Tenacity, g. per den. | Wet (Complete Immersion) Elongation, % |
|---|---|---|---|---|
| Degummed silk | 4.22 | 16 | 3.40 | 26 |
| Viscose | 2.00 | 18 | 1.00 | 28 |
| Acetate | 1.40 | 27 | .85 | 36 |
| Vinyon No. 1 Yarn | 4.00 | 18 | 4.00 | 18 |
| Vinyon No. 2 Yarn | 2.30 | 25 | 2.30 | 25 |
| Vinyon No. 3 Yarn | 1.00 | 120+ | 1.00 | 120+ |

The shrinkage or crimpage of the yarn can also be controlled by a solvent-non-solvent bath. Thus, either such a bath or proper temperature control can be used to reduce "laddering" in knitted goods or thread slippage in woven goods. This characteristic is also of advantage in controlling the porosity of woven constructions such as industrial filtering fabrics.

Up to now, the characteristics of Vinyon fiber have been investigated more thoroughly for industrial fabrics than for other possible uses. In one series of tests, fabrics of continuous filament yarn were made to correspond closely with several usual industrial fabrics in respect to porosity. The fabrics varied in weights all the way from 5.14 to 29.25 oz. per sq. yd., and included plain, twill, and chain weaves and napped fabrics. Since the practical heat limit to which the fabrics may be subjected is around 150 deg. F., sample fabrics were submitted to plants having mineral acid and alkali filtering processes at temperatures of that order.

Reports received on the stability of the filter fabrics made from Vinyon yarn confirmed the expectancy that they had many possibilities for use in filtration. In a number of operations selected for experiment, the samples outlasted hair cloths, wool, and treated cotton fabrics. In addition, their resistance to moisture, mold, and mildew was found of value in applications where a high incidence of mildew occurred in fabrics of organic origin. Already these fabrics are being used by chemical and dyestuff manufacturers in various sections of the country.

Because the yarn is thermoplastic, it is not, at present, generally recommended for clothing or similar purposes, unless composited with other fabrics for special effects. Composite fabrics of the yarn show good promise. A procedure for dyeing the yarn to any of a wide range of colors has also been developed. It can be delustered to any extent by incorporating a pigment in the spinning "dope." A mild delusterization can be also accomplished by a new process which has no effect on the tensile properties of the yarn.

The continuous filament yarn offers possibilities for long-lasting knitted and woven goods and braided articles, especially such items as chemical-resistant hose, sporting goods, nautical appliances, and other items used under conditions where the thermoplastic properties of the yarn offer no disadvantages.

## Towards Manganese Self-Sufficiency

IN THIS TIME of international conflict with its consequent disturbance of foreign trade, the matter of national self-sufficiency takes on increased importance. Manganese is one of several critical materials that become of great significance when we realize that an average of 14 lb. of it are required in the making of every ton of steel used in the United States. Notwithstanding this importance, the vast American deposits of low-grade manganese have been of slight value to the steel industry which has imported more than 90 per cent of its requirements from foreign countries where high-grade manganese is available.

Modern chemical engineering research and development entered this picture, however, when the Cuban-American Manganese Corp., subsidiary of Freeport Sulphur Co., developed a successful process for concentration of low-grade ores.

It all started back in 1930 when research was conducted at the Colorado School of Mines, but for the first two or three years the results both from the standpoints of grade and recovery, and cost as well, were very disappointing. During the last two or three years of intensive work, however, various phases of this problem have been investigated at M.I.T. and Columbia University, as well as in the company's laboratories at Grand Ecaille, La. and in the laboratory and plant at Vristo, Cuba.

The technical problems surmounted in the first plant solution were so numerous as to be difficult to present in this brief summary. They involved the development of a special grinding circuit to unlock the mineral without producing the fines that first caused excessive sliming. The answer to the flotation problems came only after devising means for a very close pH control in the use of water as nearly zero in hardness as possible. That in itself was a difficult problem and required an ingenious solution. Three different laboratories of the company worked on the problem of finding the right flotation reagent before an entirely successful process was finally developed.

Problems still remained once the manganese mineral has been re-

Typical flotation floor. Flotation machines in "rougher" section. 4 banks of cells in each of 3 sections

Dewatering drag conveyor delivers concentrates to bins for drying as sinter plant feed

covered from the ore by flotation. In the initial plant installation, standard drying and sintering equipment had been installed but were unsuccessful because of excessive dust formation. The final solution resulted in the installation of a 90-ft. long rotary sintering kiln of revolutionary design. It is understood to be the only kiln of this type in operation in the western hemisphere.

Now it is possible to convert a low-grade ore into a high-grade manganese sinter which is superior for ferro-manganese production to the best Russian ore. This operation is believed to include the only successful flotation of an oxidized manganese ore. Since it is estimated that more than enough manganese ore exists in this country to convert into steel, all the known iron ore in the United States, it seems probable that the day is not far off when the American steel industry will be entirely independent of foreign manganese supplies, an independence which is very important.

## Phosphate Plants Continue Growth

ONE BRANCH of the inorganic chemical field which has not been over-shadowed by the fast-moving organic chemical developments of recent years is phosphorus and its compounds. Pioneering in many of these advances is the Victor Chemical Works which built the first successful fuel-fired blast furnace and in 1938 completed a new electric furnace plant in Tennessee. It is now adding two more furnaces there which should go into operation before the end of the year.

Beside the new furnaces, the company is installing equipment for an entirely new and improved method for the preparation of phosphate rock. By the end of the year, the total investment at Mt. Pleasant, Tenn., will be probably more than $2,500,000.

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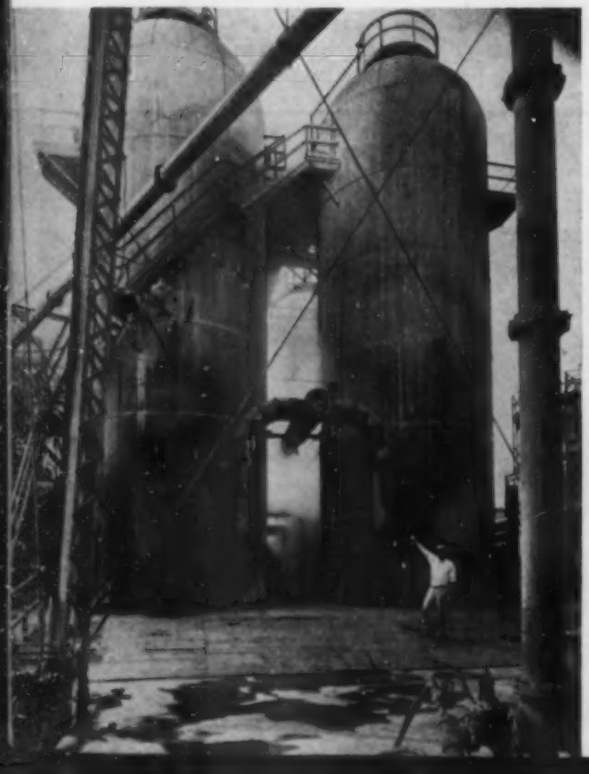


In this same plant there has been a great improvement in the purification of phosphorus. Sludge removal has always been a very troublesome feature and the problem has been solved by a novel chemical engineering method developed by Victor's engineers.

Also in 1938 a new plant for the manufacture of tetrasodium pyrophosphate—a product which has become of great importance in the soap detergent industry—was built. This plant is probably the largest producing unit in the United States, fitted out with the most modern chemical engineering equipment as well as an up-to-date control system. Low-costs achieved here made it possible to reduce materially the price of this important commodity.

A plant for the oxidation of phosphorus was built in Chicago Heights in 1939. Employing a continuous process for burning this element, the plant purifies the product and produces a highly concentrated phosphoric acid.

Of interest and importance to communities whose water supply is contaminated by the presence of fluorine, a process has been developed for the elimination of this element from drinking water by the use of lime and phosphoric acid. This, too, is a process developed by Victor's staff of research chemists and engineers.

A further development of the company was a new kind of monocalcium phosphate used for baking purposes. The outstanding feature of the new product is that it has a slower reacting effect when combined with bicarbonate of soda and yields improved oven products. It is believed that these improvements are of such importance that the per capita consumption of flour in the United States will be increased during the next few years.

The most significant outward sign of the importance of all these Victor developments is that the company has found it necessary to increase its employment approximately 100 per cent since 1929.

## A Year's Achievement

A YEAR AGO when the Owens-Corning Fiberglas Corp. was organized by the Corning and Owens-Illinois companies, its commercial products were limited to thermal insulation, electrical insulation and air filters. Today, according to its president, Harold Boeschenstein, the new company is supplying Fiberglas for essential service in 565 groups of products. Of these, only 15 are visible to the layman. In other words, the new form of glass has become an important industrial material that is fabricated into literally hundreds of manufactured products—from an automobile generator to a bag filter in a chemical plant. As a result of the rapid growth in volume of its business, Owens-Corning has increased its laboratory, plant, office and field personnel 81 per cent since Nov. 1, 1938. Plant facilities have been extended at a comparable rate—in fact, that expansion is still under way.

One of the attractions at the New York World's Fair was a motor insulated with Fiberglas. Beside it was a larger motor cotton wound. Each motor delivered 10 hp. The smaller motor occupied 45 per cent less space. It weighs 164 lb. less—190 lb. as against 354. Yet, day in and day out since June 10, 11 hours a day practically every day, this little motor has been delivering the same power with the same ease as the larger motor beside it. Both motors are 3-phase, 60-cycle squirrel cage induction motors, totally enclosed and fan cooled, and both operate at 220/440 volts at 1730 r.p.m. But here the similarity ends.

The secret of the amazing performance of the small motor lies in the skillful use of the electrical and physical properties of Fiberglas.

## Sea Water Bitterns

ANOTHER DEVELOPMENT that has increased the raw material resources of the United States is the commercial production from sea-water bitterns of all tonnage grades of magnesia, for both refractory and chemical purposes. In its plant at Newark, Calif., the Westvaco Chlorine Products Corp. can control the quality of its sea-water magnesia, a strictly manufactured product, within far more narrow limits than is possible with products originating from mined magnesite.

The actual work on this sea-water magnesia development included the determination of methods for the proper washing of oyster shells which occur abundantly in San Francisco Bay, in order to give an almost pure source of calcium carbonate for lime production, together with the design and testing of equipment to be installed on dredges which now regularly remove the oyster shells from the floor of San Francisco Bay. Following this, it was necessary to develop conditions for the manufacture of a proper grade of quick-lime from such oyster shells suitable not only for use in the magnesia plant, but also for sale in general lime markets.

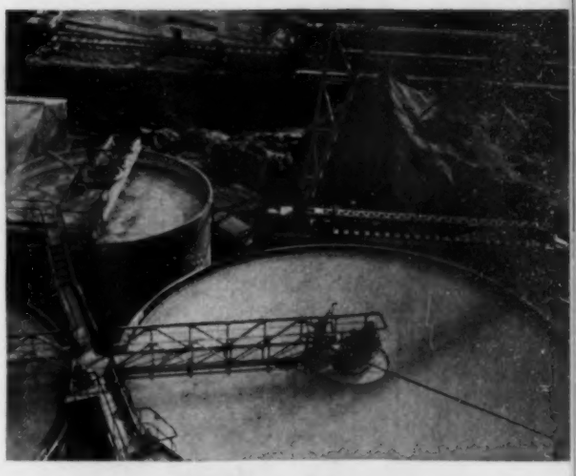
Next was the development of a magnesia reaction system which would take the lime thus made and react it with magnesium chloride in such a way that the resulting precipitate, instead of being the light, flocculent, slow-settling milk of magnesia, would be a granular, dense, fast-settling precipitate which would allow the washing and filtration equipment to be of reasonable size.

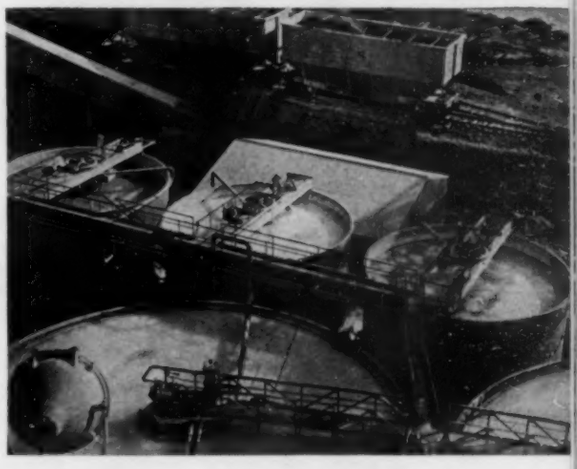
Side by side with this work went the development of the gypsum reaction system which, through proper recycling, reacts spent calcium chloride with raw sea-water bitterns and recovered sulphate values as gypsum. Finally these were transformed into the proper marketable form. (In this connection a very interesting development in the structural gypsum field will follow shortly. This is possible because of the availability of almost chemically pure precipitated gypsum.)

Finally, there was the job of converting the purified magnesium hydroxide which the magnesia reaction and the wash system turned out, into a line of marketable products. As a part of this work, it was necessary to define for the first time (as far as published literature goes), the properties of the quarternary system $CaO$-$Al_2O_3$-$SiO$ + $MgO$ in excess, so that a working hypothesis for the formulation of superior grades of refractory magnesia could be developed. With the data for the quarternary system at hand, it was possible to write a prescription for a refractory composition. Such compositions were made and subjected to full-scale tests in open-hearth furnaces.

Certain of the compositions so made have now been used very generally throughout the country and are reported to be giving a rather surprisingly good account of themselves in the hands of open-hearth operators. Obviously, the development of the necessary grain characteristics in such refractory products involve the study of kiln design and kiln operation in considerable detail. There was little to guide the experimenters in the way of experience showing the development of a dense, extremely refractory, grain material in any normal rotary kiln.

Aside from the main job discussed above, has been a very interesting piece of work in the development of extremely active magnesias, having the power of absorbing colors and acidic materials. Here the problem was primarily one of developing a burning technique, allowing control to a degree never previously approximated in rotary kiln operation.





**In the foreground of the top illustration is a wash thickener and behind it is an agitator. In the lower picture are 3 agitators arranged in parallel at the Newark, Calif., plant**

**Newark, Calif., plant of Westvaco Chlorine Products Corp. The quality of magnesia from sea water can be controlled within narrow limits**

# Progress Through Research

*A study of the continuing and varied research programs of many equipment makers shows numerous advances that benefit the Chemical Process Industries.*

**42 EQUIPMENT COMPANIES REPORT:**


**CHARLES F. ROTH**
*Manager,*
*Seventeenth Exposition of Chemical Industries*
*New York, N. Y.*

**Employment of an average of 28 research workers per company;**

**Expenditure of more than $3,500,000 annually in research work.**

**Thirteen companies report investments of $6,610,000 in research facilities.**

PROGRESS of twenty-five years in development of chemicals, chemical products, chemical engineering equipment, instruments and materials of construction will be shown by the Seventeenth Exposition of Chemical Industries next month in New York City. This progress is no mere coincidence. It has not been achieved by haphazard or occasional effort on the part of exhibitor companies. It is the result of carefully planned, generously financed, continuing research.

Perhaps this type of research or development is less generally recognized than is the comparable effort of other groups who serve the process industries. For this reason the management of the Exposition decided to undertake an appraisal of this aspect of the work of its exhibitors. The results have been most interesting. The chemical and chemical product manufacturers indicate research activity which corroborates the data assembled in the Facts and Figures Issue (September 1939) of *Chem. & Met.* The returns from the group making chemical engineering equipment, instruments and materials of construction present an aspect of research work performed which appears not to have been studied previously. The latter show why much of the development has been accomplished and how that progress has been significantly based on the scientific and engineering knowledge which only carefully executed research could have furnished.

Correspondence with a number of the important companies of all sizes who regularly participate in this biennial Exposition was carried on. Fifty such firms have cooperated by supplying information regarding their research staffs, their research expenditures, and the objectives of this scientific and development work. This very stimulating information will, it is hoped, be interesting and useful to other divisions of chemical engineering.

Just 42 equipment and equipment material companies have supplied sufficient information to permit a statistical summary of this type of activity. These firms at present employ approximately 1,190 men on research. That is an average of 28 men per company. It appears that the average spending per research man is approximately $5,550 per year for personal compensation and research expenses. In addition there appear to be large permanent investments required since the current expenditures

of these 42 companies certainly exceed $3,500,000. Thirteen of these companies reported a total investment of $6,610,000 over a period of years.

The investment in buildings, machinery, test apparatus, and other facilities back of the research is probably several times this much. And one should remember that this group of companies which have furnished data is only a part of the chemical engineering equipment business of the country. It would be easy to extrapolate the curve to show a rather amazing total sum involved in the investigations and development work which have contributed to the progress which is so conspicuously displayed each biennium as these firms get together to demonstrate to chemical engineers their latest machinery and facilities.

### Definition of Research

It is not easy to define research in chemical engineering equipment fields. In fact it is almost impossible to say where research stops and development begins, where development stops and engineering sales or special design work is undertaken. Fortunately, it is not important here to draw any sharp line between these various parts of the whole job. In the aggregate it is probably fair to call all of this type of equipment improvement effort by the name "Equipment Research."

A limited number of equipment companies carry on, as a part of their research program, what they term pure research. This deals with fundamental physical phenomena or with the kinds of studies for which there is not evident an immediate practical application. The hope is, of course, that some new facts will be developed that will lead to an entirely new sort of machine or device or entirely new process. Many of the companies doing this type of work recognize, however, that the byproducts of this very fundamental work are often more valuable to them than any direct result originally sought. Not infrequently in surveying the chemical equipment field, one finds that as a secondary result of some investigation, an entirely new kind of device or machine or process has been made possible.

One of the questions which was asked of the various equipment companies during our survey of research activity was "How many industries will benefit from your researches?" The answer received to this was almost embarrassing. It appears that many of the investigations, regardless of their initial purpose, have been producing results of such wide application that the reply to this question often is rightly "The benefits extend to all industries."

### Interdependence of Industries

One of the conspicuous results of equipment development in the chemical engineering field has been the adaptation of machinery formerly used in one industry to the needs of other types of business. The chemical engineer borrows from the mechanical engineer, the civil engineer, and others. The paint man develops grinding machinery and suddenly it is found in the breakfast food plant. This apparently is only a natural consequence of the fact that the unit operations which underlie much of the machinery are common to a wide variety of manufacturing. Furthermore, it is safe to conclude that one reason why the Exposition of Chemical Industries is a success and renders a real service lies in the fact that a wide variety of chemical processing requires attention to the same relatively few methods and principles on which equipment is designed and built.

In their replies to us, most of the machinery companies indicate a great diversity of service expected from their equipment. Just a few quotations of phrases will show how odd the combinations sometimes are. The industries so grouped by companies are significant: "Paper, chemical, metallurgical, food, cement, petroleum"; "Pharmaceutical, beef, agriculture, textile, construction"; "Sugar, coffee, salt, drugs, cosmetics, liquors, chemicals, specialties"; "Rayon, pharmaceuticals, plastics, storage batteries, welding-rod, food products." And one could cite a score more of equally strange and seemingly unrelated combinations of industries served.

### It's Not All Machinery

Any modern exposition is far from complete if it presents only the great machinery of manufacturing. Almost equally important at the Chemical Exposition are the closely related exhibits and problems of construction materials and the instruments and control devices which go with the machines themselves. Some of the largest spending for research by equipment companies is disclosed in the fields of materials of construction. One needs only to recall the activities on aluminum, nickel, alloy steels, and a dozen other modern materials for equipment building, including plastics and many other non-metallic products, to understand why that field is so closely interrelated with the machinery research job. It is, of course, obvious that many machines would not themselves function satisfactorily for many prospective users if it were not for the new materials out of which this equipment could be built.

More and more, apparently, the successful operation of new large-scale machinery depends on the automatic

## WHY EQUIPMENT MAKERS SPEND MONEY ON RESEARCH

Here are a few quotations that are typical of the reasons why the manufacturers of chemical engineering equipment have invested heavily in research and development work:

"We consider that our investment in research is really an investment in behalf of the American process industries in that the results of our research are broadly applicable throughout the whole field; results generally in better processing methods and, as a rule, result in our clients obtaining greater margins of profit and being in a position to employ additional labor."

"The objectives of our research are threefold: First to retain our leadership in the fields we serve; second, to make our existing equipment and processes do a better job at less cost to our clients; third, to develop new products and new fields to counteract the tendency of old fields to be saturated."

"Manufacturers of the process industries can cooperate by furnishing accurate and detailed information regarding their problems so that our investigations can be based on reliable data."

"We are studying means of improving our products metallurgically; improving engineering design and lowering production costs. We are constantly studying other markets in order to extend and broaden the use of our products. We are studying our customers' problems with the view of reducing their costs by changes in process which changes are made possible and practical by improved and lower priced equipment which we can manufacture and supply."

maintenance of conditions for the machine or for the materials that it is treating. That job has been accepted as a research responsibility of a number of companies which participate biennially in the showings to chemical engineers. It is a growing occasion for research spending.

### Engineering Development Jobs

A great many jobs encountered by equipment builders apparently have to do with the translating of a small-scale laboratory method into a full-scale plant for commercial use. This appears to mean generally research on many things which must be changed between the laboratory glassware stage and the big machines which are going to do the work on a profit-making scale. Some companies choose to call this development work. But for the equipment man, the job is frequently one of fundamental research. The result may be only a new "special job" design; but back of it may be a great many equipment problems, if one can judge by the comments of machinery builders. Frequently, these men say, the only successful progress comes when they have a three-party conference. The machinery man, the prospective user of the machinery, and the material of construction men, must get together for a successful result. Perhaps one cannot call the conferences and the subsequent experimentation "research", but the result is something new and serviceable which will permit a plant to work. And the translation from laboratory to profitable plant basis is an achievement no matter how one looks at it, and regardless of who gets the major credit.

Very frequently equipment men doing research and development work either for their own purposes or for their customers are confronted with difficult questions as to secrecy. The difficulty is generally a minimum when they are doing investigations on their own responsibility for new types of machinery or new models of old. But even there, the real test of the device must be the way in which it operates in practice in some customer's plant. That means that there must be established a working basis for cooperation between the man who builds the machine and the man who will use it.

The code of ethics which is developing among equipment builders in relation to these joint problems is very interesting. Apparently it has never been written down, but it forms the whole basis of successful cooperation between the manufacturers and those who come to the Exposition for new ideas and improvements for their home works.

The public showings of the results of research are proving more and more not only a proper form of advertising of the machinery exhibited, but also an evidence of leadership and even some proof of the proprietary right on the part of those who have spent money to build new things which many machinery users want to employ. No matter what the patent law on this subject may be, it is clear that there is a special function of expositions and advertising in order both to gain prestige for the new development and to stake out certain rights in ownership of ideas and improvements.

When one recalls expositions and problems of earlier years, it is evident that this question of ethical relationship between builder and user of machinery and accessory devices has gone a long way toward a fair understanding by both sides of the responsibilities of each party to the other.

### The Evidence of Progress

Chemical engineering today is a very different thing than it was twenty-five years ago when the World War conditions justified the opening of the first Exposition of Chemical Industries. The millions which have been spent on equipment research by chemical manufacturing equipment builders, materials men, instrument companies, and users of machinery have borne fruit. Today many new sorts of equipment are shown, many radical modifications of old, an amazing variety of materials of construction, and instruments and automatic controls almost legion in number.

The result of all this appears to be a lower cost plant operation and a productivity unknown a quarter century ago in almost every line of chemical manufacturing. The equipment builder does not claim all the credit for this. But he has been an important contributor. He has learned how to increase the effective size of machines. He has provided better made, more durable equipment; and he has done this oftentimes at very much lower cost. The power requirements and the fuel used in modern machinery are much less than even ten years ago. For much of this improvement the equipment man really deserves substantial recognition.

He has been well aware that the purchases from him are a matter of investment, not a matter of current spending. He has sought constantly to give a greater unit capacity for every dollar so invested. He knows that thereby the capital costs are lowered and the continuing downtrend in price of products can be maintained with national public benefit.

An amazing number of the comments which have come to us in the course of our discussion of research with exhibitors has emphasized the long-time *public* benefit of the investigations. To be sure, no company claims to be altogether altruistic. Nor is it ever assumed that the machinery purchaser is not the one whose interest is primary. But running through the whole comment on this subject is the thought that unless there be a general public benefit in better and cheaper products made by the industry which uses the machinery, we are not really making substantial progress.

**Every other year hundreds of companies exhibit the products of their research in equipment and chemical engineering materials at the Chemical Exposition in the spacious Grand Central Palace, New York City**

# Chemical Engineering Advances

## In EQUIPMENT AND OPERATION

**Herein, in the next 33 pages, we present a double-barrelled feature: a word-and-picture survey of the new equipment to be shown at the Chemical Exposition; and a flying trip from 1915 to 1939, conducted by 19 well known contributors, which is designed to show how equipment advances since the first Chemical Show have contributed to better plant operation.**

# 17th Chemical Exposition Preview

***In 1935 and again in 1937* Chem. & Met.** ***essayed the task of determining in advance of the Chemical Exposition what new developments in equipment and construction materials would be displayed at the "Chem. Show." The response to these past efforts was so good that the same sort of Preview is presented again, covering equipment and construction materials showings that are new since the Show in 1937. About 150 exhibitors responded. Other new things to be disclosed at the Show will be covered in the December issue. In addition to the Show report, short reviews of operating advances in the period since the first Chemical Show in 1915 are also discussed in this section by a group of experts recognized in the fields they cover.***

PERHAPS the best evidence of the advance that Chemical Engineering is making from year to year and from Chemical Show to Chemical Show is the visual evidence that is best gleaned only by a careful and thorough inspection of this colorful biennial display. Not all *Chem. & Met.* readers will be able to attend, however, and for them, as the "next best thing," *Chem. & Met.* offers as complete information as is available at the time of going to press on the new developments and improvements since the last Show which will be displayed at this one. Those engineers who will attend the Show should find that on the basis of this advance report they will be able to budget their time and so accomplish their coverage much more efficiently than without this assistance.

## CENTRIFUGALS, FILTERS AND THICKENERS

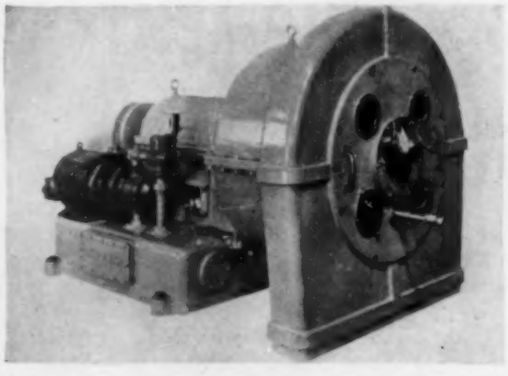
AT THE Chemical Show two years ago, Baker Perkins Co., Saginaw, Mich., introduced the ter Meer discontinuous bulk centrifugal. Recently the company has announced a continuous ter Meer centrifugal which will be displayed this year. The new machine is of interest where free-draining solids must be separated from liquid slurries. Its perforated drum spins continuously at full speed on a horizontal shaft. A continuous stream of slurry is fed to the machine, the solids and liquid being continuously separated and discharged. Passage of the solids through the drum is accomplished by an oil-pressure operated reciprocating piston. At any time adjustment of the stroke frequency of the piston may be made without interrupting production so as to adjust the holding time in the drum. An even cake thickness is said to be assured with even distribution of the load. Various features are said to prevent degradation of particle size. Sizes range from 2 to over 10 tons capacity per hour.

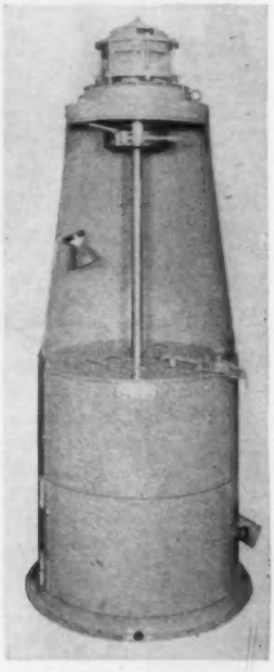
The latest model of the continuous centrifugal solid bowl filter made by the Bird Machine Co., South Walpole, Mass., will be on display for the first time. This type of machine handles solids varying in size from ⅜ in. mesh to a fraction of a micron and is stated to be extremely flexible in regard to volume of throughput or character of feed. Thorough washing is permitted if desired. Filter screens and cloths are eliminated. The new filter is built in three sizes, its use being recommended by the manufacturer for a wide variety of chemicals, pigments, metallurgical concentrates and sludges. It is claimed that the centrifugal sedimentation principle employed is equally effective in permitting sharp separations according to particle size when operating as a classifier rather than a filter.

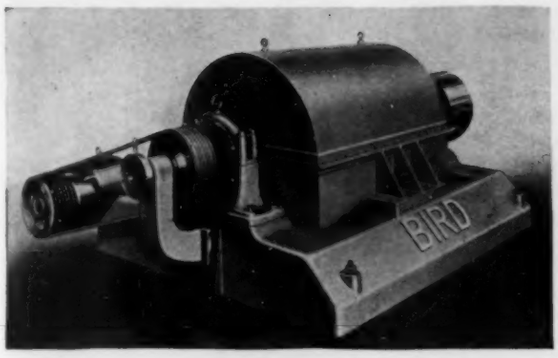
Among the several centrifugals to be shown by the Fletcher Works, Philadelphia, Pa., will be a new 20-in. cone suspended centrifugal furnished for either direct motor drive with the rotor mounted on the main spindle, or with a V-belt motor drive, the motor being mounted behind the supporting cone. This new machine is extremely compact and is equipped with a bottom discharge for solids which can be collected in a receptacle beneath the curb, if desired. The machine illustrated has a solid basket with skimming nozzle for removing the liquid. Perforated baskets are also available.

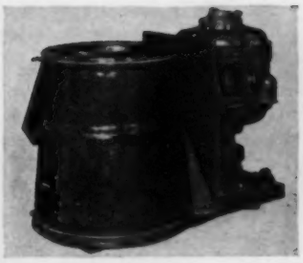
The Reineveld Corp., New York, will exhibit a horizontal bulk centrifugal developed in Holland, but new in the United

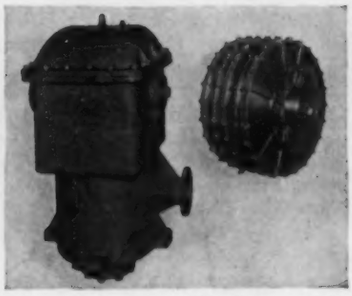
**At the right is Fletcher Works' new 20-in. cone suspended centrifugal and below the Baker Perkins continuous ter Meer centrifugal**



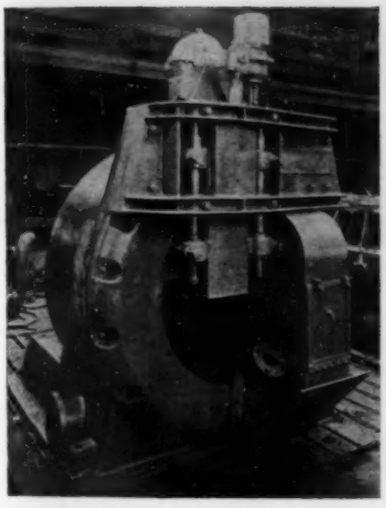


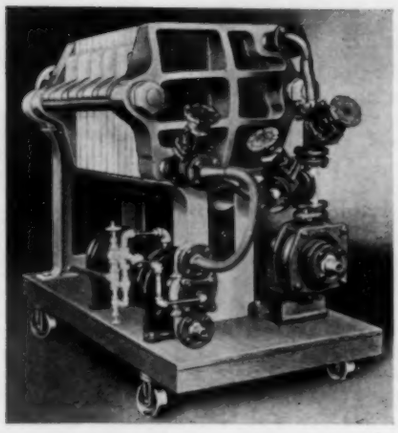




**Bird Machine Co.'s new solid bowl continuous centrifugal appears at the left, the Tolhurst 9-in. machine, above, and the new Purolator disk filter at the right**





**Duriron heating and filtering unit**
**Left—Reineveld horizontal centrifugal**

States. The outstanding feature of this machine is the location of the main bearing at the center of gravity of the revolving mass. This feature is said to eliminate vibration and permit higher speeds than when the bowl or basket is suspended on a shaft between two bearings. Absence of vibration and the rigidity of the shaft enable the motor to be built into the machine and thus reduce required floor space. In this machine both perforate and imperforate bowls in sizes from 16 to 80 in. in diameter are available.

Among several improved models of its various types of basket centrifugals, the Rochester Engineering & Centrifugal Div. of the American Laundry Machinery Co., Cincinnati, Ohio, will exhibit two types which are completely new. One is an under-driven chemical centrifugal made in sizes from 17 to 30 in. basket diameter, which is particularly designed for clarification, thickening, classifying and filtering of chemical materials. Stainless steel, Monel metal, brass, bronze, copper, rubber or lead-lined construction is used. Another new development is a 9-in. small-production and laboratory machine which is also under-driven. This machine features a particularly compact design employing a vertical motor mounted on the same base as the centrifugal.

In the booth of the Sharples Corp., Philadelphia, Pa., will be two new Sharples centrifugals which serve an entirely new application. On neither of them will details be available until the time of the Exposition.

Several new centrifugals will be featured by the Tolhurst Centrifugal Div. of American Machine & Metals, Inc., East Moline, Ill. One is a new suspended centrifugal designed for high speed operation to obtain maximum centrifugal force and consequent short operating cycle and low moisture content. A new small batch solid-curb centrifugal for processing fine chemicals is another. A variable-speed open-top laboratory centrifugal with bottom drive, equipped with removable, interchangeable perforate and imperforate baskets is still another. This machine can be made fume-tight when required.

### Filters

A line of fiber glass filters made in sizes up to 6-in. diameter is to be exhibited by Ace Glass, Inc., Vineland, N. J. These filters are made of fibers of Pyrex glass in a variety of different average pore diameters. The fibers are sintered together for permanence of pore size. Side connections to the 6-in. filter can be made of 1½ in. diameter glass tubing, or larger.

Among the recent developments to be shown by American Seitz Filter Co., New York, is an improved form of this company's single-disk Junior filter which can be simply expanded to a multiple unit by adding filter screens. This filter takes a 16-in. square sheet of filtering material, a more economical use of the material than in the cutting of round sheets. A special type of bypass plate is available for series filtrations.

A recently developed heating, filtering and circulating unit built especially for plating solutions will be shown by the Duriron Co., Dayton, Ohio. As shown in the accompanying illustration of a portable model, this consists of a heat exchanger, filter press, centrifugal pump and the necessary valves and piping. All equipment coming in contact with the plating bath is either of Duriron or Durichlor. In the portable model the capacity is sufficient to handle baths up to about 1,000 gal. Stationary installations of the same general type will handle baths as large as 10,000 gal., or even more.

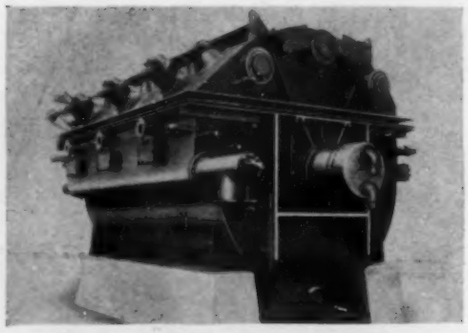
What is known as the FEinc repuddling process is a new development to be shown by Filtration Engineers, Inc., New York. This process and equipment is used in conjunction with continuous rotary drum type filters to induce greater dewatering of filtered materials than has heretofore been possible with filters of this type. It is of almost universal application, according to the manufacturer. The device employed alternately subjects the cake to periods of vibration (from the exhaust of the vacuum pump), and to vacuum. This cake treatment is done during the portion of the cycle before the cake is discharged from the drum surface. It is controlled by solenoid valves and a timing device. The agitation is said to cause a rearrangement of the particles of the cake, making the water trapped in the interstices available for extraction, so as to give a drier and more easily handled cake.

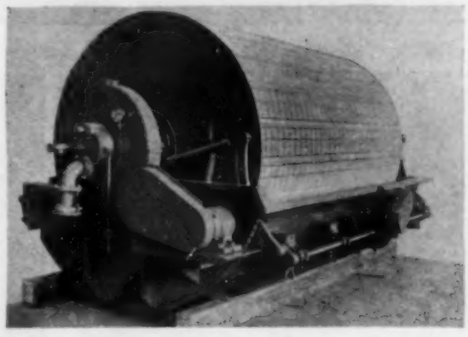
What is claimed to be an important improvement in rotary vacuum filters, the Birmingham DriCake discharge, will be shown by Goslin-Birmingham Mfg. Co., Birmingham, Ala., in connection with a conventional vacuum drum filter. This device is a mechanism for draining all filtrate lines of the filter prior to blow-back, thus avoiding the loss of residual filtrate into the cake on the blow-back operation. It employs a sup-

plementary connection from the valve to the after end of each filter compartment in the drum. Until the compartment reaches zenith the supplementary line serves as an additional filter compartment drain. From zenith to the point of blow-back the supplementary line permits a small, adjustable amount of blow-back into the filter compartment which thus forces out any filtrate retained in the compartment and in the drain line.

Type G-126 is the designation of a newly designed Purolator which will be exhibited by Motor Improvements, Inc., Newark, N. J. This filter is self-contained and has for the filtering medium five double-faced disks of this company's standard wire-wound construction. The wire is a metallic ribbon, one surface of which is smooth, with the other surface provided with projections of uniform height and definite spacing. When this wire is wound in clock-spring fashion on a suitable frame, the open area produced is said to be a greater percentage of the total surface area than is obtainable by any other known method. Hence a smaller, lighter filter for a given flow rate can be produced. Wire spacing can be up to the equivalent of 400 U.S. standard mesh.

Of the six types of filter to be exhibited by Oliver-United Filters, Inc., New York, two are recently developed types which have undergone marked evolution in the period since the last Chemical Exposition. One of these, the Oliver Precoat filter, was tried out experimentally about three years ago on pigments, then on oil. This filter has now been greatly modified in design and materials of construction to fit it for much broader work. Hooded or inclosed types are available for continuous operation under pressure or vacuum. Special materials of construction may be employed. Filters of this type are now operating in the petroleum industry, in food products and in chemical plants. Both open and inclosed types are available in sizes from 3 to 300 sq.ft. of filtering area. The second filter referred to, the Oliver low-submergence, low-discharge type, was also first introduced about three years ago and has since been simplified and made more accessible, with easily removed agitators, short rubber hose connections for piping, and removable rubber cake deflector. In some recent applications very little of the drum is submerged, most of it rotating through the washing and drying zones. Faster operation, better washing, higher efficiency and elimination of practically all wear on the cloth are claimed. The cake falls away by gravity, requiring little blow-back pressure.





**Two new Oliver filters, an inclosed Pre-Coat filter above and a low-submergence filter below**

The Selas Co., Philadelphia, Pa., will show a new line of American-made porcelain filter candles and other shapes which feature rapid filtration and easy cleaning and are claimed to minimize clogging. It is stated that the manufacturing process provides accurate control over the number of pores per given area and by raising the number of pores without increasing pore size, a high filtration rate may be obtained. Five standard pore ratings are produced, with filtering areas up to 30 sq. in. available.

Various recent developments in filter presses will be shown by T. Shriver & Co., Harrison, N. J. One development of this company since the last Chemical Exposition is a large filter press built especially for the handling of granular, loosely-packed and relatively porous materials which must be filtered rapidly and washed to produce filter cakes of large volume. Its use on brewer's mash is said to be particularly noteworthy. The press illustrated is 43 in. square with 24 filter chambers. This company's grid-type plates are covered with perforated sheets over which the filter cloth is draped. Particularly thick frames are used to provide ample filter cake capacity. A hydraulic closing and locking device is employed.

### Thickeners and Classifiers

In addition to a display designed to illustrate graphically the principles of sedimentation, classification and flocculation, the Dorr Co., New York, will exhibit its latest development, the Squarex clarifier with a built-in flocculation compartment. This is a new type of clarifier for installation in square sedimentation tanks of either the central siphon-feed

## THEN AND NOW IN PLANT OPERATION

**DAN GUTLEBEN, engineer, is known throughout the sugar industry for his famous log. It records every notable advance that has been made by the Pennsylvania Sugar Co.—and a lot of interesting philosophy besides. His personal experience with sugar centrifugals goes back 40 years ago, but he confines his comments below to developments during the past 25 years.**

MANY SUGAR-HOUSE CENTRIFUGALS that were installed twenty-five years ago are still performing. Some, like Grandfather's famous knife, have at various times been fitted with new blades and handle but are still in production. They do not travel on the streets to publicize their age. The good old speed of 1,000 r.p.m. for a 40 in. diameter basket produced a reasonable structural load on the metals available. A pull of 600 times gravity removed the syrup from the crystals satisfactorily enough when the possibility of improvement had not been sensed.

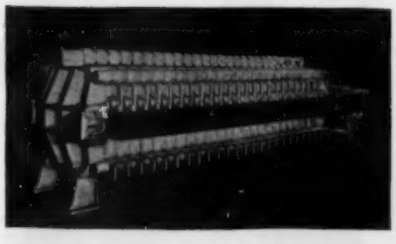
The outstanding development has been the increase in speed and the shortening of the period of acceleration. Today with a speed of 1,800 to 2,200 r.p.m., a certain massecuite has produced lower purity syrup and higher purity crystals in a 10 min. cycle than the old 1,000 r.p.m. machine produced in 30 min. Furthermore the temperature of the mother liquor, especially in the affining process, is increased to reduce the viscosity and thereby permit the centrifugal force to remove the syrup more effectively. The fashionable temperature of the affination syrup used to be around 100 deg. F. Now the adherence of the syrup to the crystals has been weakened by heating it to 185 deg., the saturation point having been raised to avoid melting of sugar grain at the higher temperature.

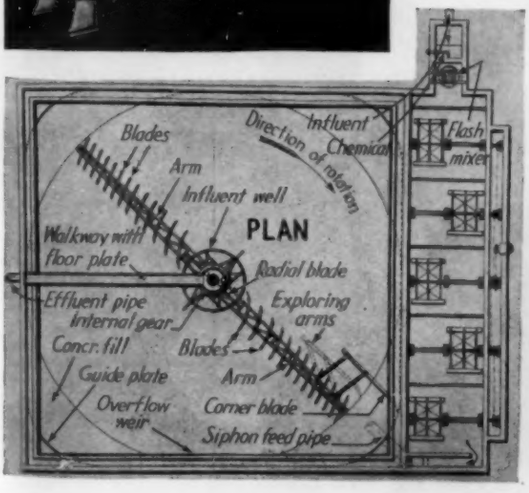
Recently an old idea has been resurrected and equipment perfected by which the centrifugal curb is tightly covered to reduce chilling. Subsequently the washing is done with superheated water. By this means several advantages are attained: Less sugar is melted, less sweet water produced for reprocessing and the lesser water content of the wet sugar requires less tumbling in the dryer and therefore delivers a more brilliant crystal.

type with peripheral overflow, or the side overflow type. The siphon-feed type is similar to the Dorr Sifeed clarifier with the exception that the tank is square instead of round, one of the rigid arms of the rake mechanism being equipped with a special corner blade. This blade is positively and automatically controlled so as to reach out into the four corners of the tank and move the settled sludge in to a point where it may be picked up by the regular rotating mechanism which, of course, sweeps the area of the circle inscribed within the square bottom of the tank. The side feed type is identical mechanically with the type just described, the only difference lying in the method of feeding through submerged ports or across a weir at one side of the tank, with overflow taken off across a weir extending along the opposite end of the tank.

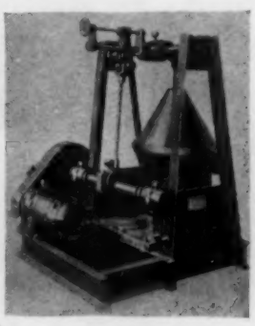
The accompanying illustration shows a siphon feed Squarex clarifier equipped with Dorrco flocculators in the same tank. A simple dividing wall separates the two elements. Even without the use of chemical reagents, it is claimed that pre-flocculation increases the settling rate of solids, either increasing capacity or improving the settling.

Hardinge Co., York, Pa., has recently introduced a number of new developments, and its display is anticipated to include several of these such as the new Hydro-Classifier, a round-tank scraper classifier for fine separations in which a swirling vortex of water around the oversize discharge at the center is employed to avoid carrying fines out with the coarse discharge. An improved overload release mechanism for its thickeners is another recent development, as is a redesigned diaphragm pump for thickener solids discharge.






**Left, a special Shriver filter press for bulky solids, and the Dorr Squarex clarifier; below a new Hardinge diaphragm pump for thickeners**



**RUSSELL W. MUMFORD, consulting chemical engineer for the American Potash & Chemical Corp. and for many years in active charge of production in its huge plant at Trona, Calif., cites some of the many changes that have occurred in evaporation, filtering and crystallizing borate and potash products.**

SINCE 1914 the climbing film and positive circulation evaporators have practically revolutionized this branch of chemical engineering. Evaporator auxiliaries such as condensers, vacuum pumps and circulating pumps have contributed greater operating efficiency while changes in materials of construction have permitted improved design. Nickel, stainless steel and other metals and alloys are now available for practically all applications.

As contrasted with 1914 the chemical engineer today has efficient rotary vacuum filters for many salts which will deliver the cake sufficiently dried for shipment direct from the filter. Batch centrifuges have become semi-automatic. Continuous centrifuges have been successfully developed for filtering and washing salts. It is now possible to segregate filtrates and wash waters from vacuum filters and centrifuges. The super-centrifuge has proved effective in separating many non-filterable colloids

The outstanding development in crystallization is the continuous vacuum crystallizer for mass production of various crystalline solids from solutions. These crystallizers eliminate or minimize scaling, corrosion and salting troubles connected with the transmission of heat from a solution through metal to a cooling medium. They are constructed with barometric or surface condensers or for low temperature work. They are equipped with high efficiency steam jet aspirators in some cases and in others the condensers are serviced with mechanical refrigeration and even with regenerative refrigeration. The operations of all crystallizers have been improved by the availability of stainless steel and other new alloys as well as improvements in the installation of protective linings of glass and rubber.

## THEN AND NOW IN PLANT OPERATION

### DISINTEGRATORS, SIFTING, SEPARATING AND DUST COLLECTION

WELDED construction is employed throughout in a new line of ball or pebble mills to be exhibited by Abbé Engineering Co., New York. These mills are made in any desired size and are supplied either unlined or lined with porcelain or buhrstone blocks. The mill is jacketed for heating with steam or hot water or for cooling with cold water or brine. Combination stuffing boxes are provided at both ends of the mill for entrance and discharge of the heating or cooling medium. These stuffing boxes can also be used for feeding liquids or gases to the grinding chamber if these are required for processing, or for evacuating vapors or gases given off during processing. Both stuffing boxes are provided with sight glasses. The mill is particularly intended for mixing or grinding in a wet or damp state at any desired temperature or pressure, and for drying in the same operation.

Higher speeds than have ever been used before in gyratory crushers are stated to be employed in the new Type R all-steel reduction crusher to be exhibited by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The crushing stroke has been selected for high capacity and a cubically shaped product. The new crusher is of simple construction, the spider and top shell being cast integral and readily removable for replacement of the manganese steel concave ring. Adjustment for wear on this liner and on the manganese steel mantle is accomplished by means of a simple hydraulic jack located in the bottom plate of the crusher. An automatic tramp iron release is provided.

H. L. Bullock, New York, will exhibit equipment made by a number of different manufacturers. A product of the Process Machinery Co., San Francisco, Calif., known as the Rietz Disintegrator, will be one piece of equipment shown. This will be the first time this vertical hammermill has been shown in the East. Developed on the West Coast, this ma-

**ALFRED GEORGE LANG, Chemical Engineer and Manager of the Pacific Portland Cement Co. of Redwood City, Calif., looks at advances in equipment for crushing and grinding especially as they have affected the development of the cement industry.**

CEMENTS and mortars of excellent hydraulic properties, which were used to bind together the cut stones of prehistoric temples in Latin America, the Pyramids of Egypt and the aqueducts of Ancient Rome, certify to the venerable nature of the cement industry. They also reflect everlasting credit to those ancient industrialists who, working with only crude stone implements and tools, somehow managed to crush and grind their material in such a way as to produce satisfactory cements which have preserved their structures unto this day.

From these ancient times up until 25 years ago, the cement industry advanced slowly at an even pace with the gradual evolution of better machinery and better technique. With the advent of steel alloys and hard-surfacing metals of high wear-resisting qualities and greater strength, the process of crushing and grinding highly abrasive cement-making materials has undergone revolutionary change. As a result the industry can produce much higher quality cement with earlier hardening properties.

High-speed crushers, equipped with alloy steel wearing surfaces and operating on extremely abrasive cement clinker, have made notable contributions toward increasing production and reducing costs of manufacture.

Modern cement-grinding units produce from 10 to 15 times the tonnage yielded by the mills of 25 years ago, with less operating labor and kilowatt-hour consumption per barrel of finished product. Thus both the chemical engineer and the metallurgist must share the credit in our industry for producing a better quality of product at lesser cost.

## THEN AND NOW IN PLANT OPERATION

chine has in the past been used largely in fruit and fish industries. Now being introduced for chemical plant use, it is available in four sizes ranging from 8 to 18 in. screen diameter. The high degree of open screen area is said to permit extremely fine grinding with little generation of heat and to allow the handling of sticky and gummy materials. Stainless construction is available if necessary.

Pulverizing Machinery Co., Roselle Park, N. J., plans to feature its new Bantam Mikro-Pulverizer in its exhibit at this year's Chemical Show. This machine is being used to grind a variety of different materials such as chemicals, dyestuffs, dry colors, sugar, clay, etc. Similar in principle to larger machines of this company's manufacture, it may be dismantled in less than 5 minutes without a wrench. The pulverizer is complete as furnished, with main motor, feed-drive motor, switches and extension cords. A rheostat for variable feed speed is also provided. This pulverizer, available in only one size, has a capacity of 30 to 150 lb. per hour on medium hard material.

Robinson Mfg. Co., Muncy, Pa., expects to show several new or improved pieces of disintegration equipment. A heavy duty steel knife cutter of recent design will be one of these. This machine, intended for cutting, granulating and shredding plastic, tough and fibrous materials, features a removable cover plate placed in front of each stationary knife to permit inspection and ready adjustment. Knives are extra heavy and cutting edges faced with inserts of high carbon steel. Other recent developments include a rubber grinder of sturdy construction with built-in motor and what is claimed to be a very effective cooling system. A pulverizer and hammermill redesigned for increased efficiency and operating convenience will also be featured.

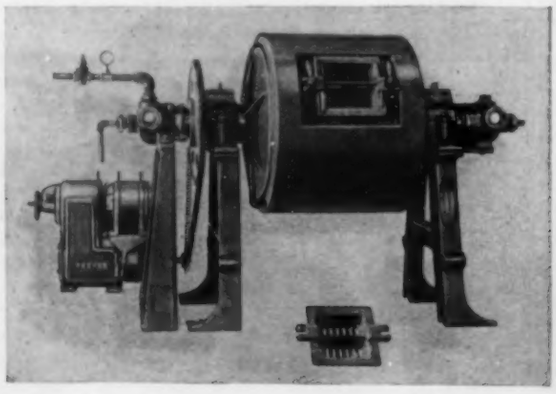
### Screens and Separators

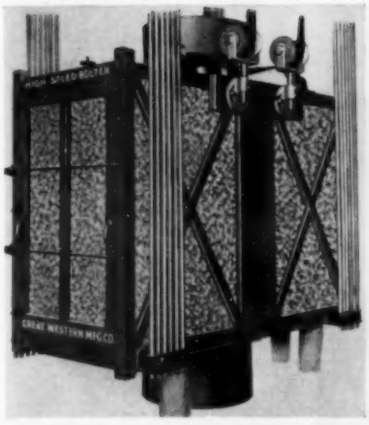
An improved model of its heavy-duty low-head gyratory sifter will be exhibited by the Allis-Chalmers Mfg. Co., Milwaukee. The machine is built as a complete unit including sifter, motor and drive all mounted on a welded steel base, the whole occupying a space of about 3x3½ x 3½ ft. high. The capacity is stated to be unusually large for the size. It is used both for re-sifting and for grading into coarse, medium and fine meshes.

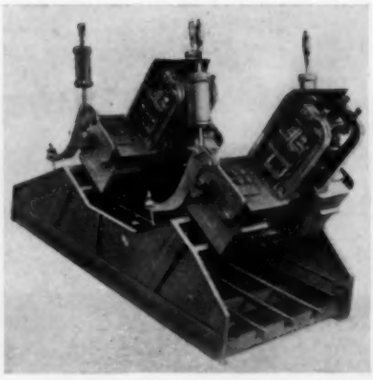
A new machine intended especially for the removal of iron contamination from finely ground dry materials which are not free-flowing will be introduced under the name of Dry-FerroFilter by S. G. Frantz Co., New York. This machine employs the same principle of magnetized screens used in this company's FerroFilters for liquid materials. A strong but isolated vibration of the screens and the parts of the machine with which the powder comes in contact is achieved by means of an eccentric mechanism and causes the material to flow through steadily, leaving the magnetic impurities attached to the screen. Cleaning is accomplished by stopping the feed and demagnetizing, which results in the discharge of the collected magnetic impurities. At present one model having a capacity of 500 to 1,000 lb. per hour, depending on the nature of the material, is available. Other sizes will later be produced. If desired, in case frequent cleaning is required, accessory devices are available which automatically control the operating and cleaning cycles. Applications are indicated on such materials as pigments, minerals, dyestuffs, chemicals, ceramics and glass batch.

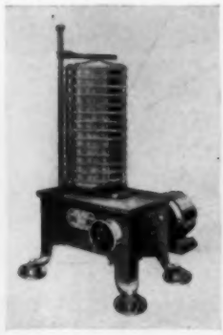
Reitz vertical Disintegrator

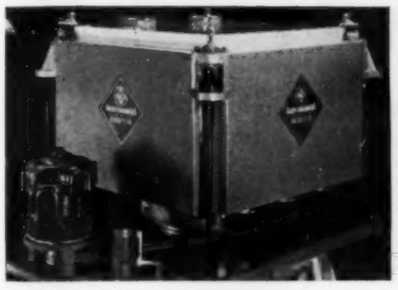
Right—New Allis-Chalmers Type R reduction crusher
Below—Abbé Engineering Co.'s jacketed ball mill

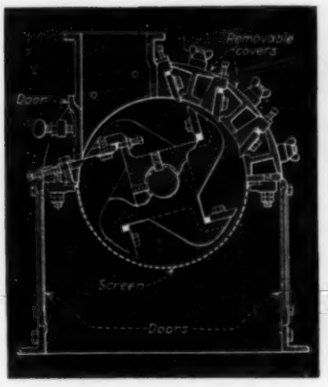


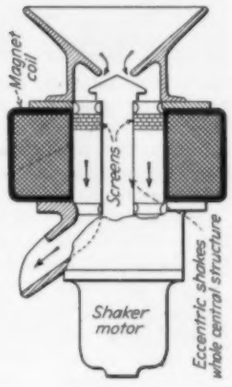









**Top, left to right: New Great Western Style G bolter; Jeffrey screen with new parallel-wire screen cloth; improved End-Shak sieve shaker; new Bantam pulverizer**

**Lower row, left to right: Allis-Chalmers low-head gyratory sifter; Robinson heavy-duty knife cutter; Frantz Dry-Ferro Filter**

In the booth of the Jeffrey Mfg. Co., Columbus, Ohio, will be shown the latest improvements in Jeffrey-Traylor electric vibrating equipment for drying and cooling conveyors, weighing feeders, vibrating spreading feeders and vibrating screens. One very recent development probably to be shown is an electrically vibrated screen equipped with a new type of stainless steel wire cloth in which wires under high tension run only in one direction with no cross wires. So tightly are these wires stretched that they develop a resonance said to have the peculiar property of passing undersized particles much more readily than the conventional types of cloth.

Newark Wire Cloth Co., Newark, N. J., will show an improved version of its End-Shak testing sieve shaker, important new features of which are an automatic time switch for automatically controlling the period of test and the use of rubber vibration-isolating feet to prevent transmission of vibration.

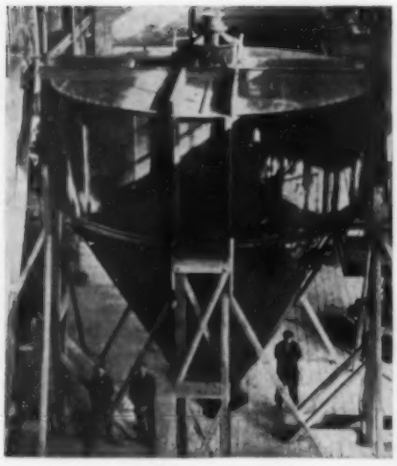
Refinement of design is a leading feature of the new Series 80 Rotex screeners to be exhibited by Orville Simpson Co., Cincinnati, Ohio. These are large capacity screens of the gyrating type. The Rotex 82 illustrated has two screen surfaces, each 40x120 in. In the 80 series are also the No. 81 with a single screen surface, 60x120 in., the No. 83 with three screen surfaces, each 40x120 in., and the No. 84 with four screens, 40x84 in.

A new type of suspended screen known as the Gyroset, the vibration of which is secured mechanically without the use of offset weights, will be exhibited by the Productive Equipment Co., Chicago, Ill. This screen may either be suspended from overhead or supported on leaf or coil springs. It is available in one, two and three deck models in sizes ranging from 1½x4 ft. to 5x12 ft. The vibrating mechanism is a positive counterbalanced eccentric running in oil and provided with anti-friction bearings. The eccentricity can be varied between zero and ⅜ in. to adjust the stroke of the screen. Another new development is a quick end-opening device for vibrating screens.

Read Machinery Co., York, Pa., will exhibit a new type of sifter which is built to give both horizontal and vertical motion to the screen surface, with the elimination of excess vibration through coordinated counterweighting. As a result of this construction the maker claims faster screening than has heretofore been possible.

Separations Engineering Co., New York, will exhibit equipment developed by Sutton, Steele & Steele, Inc., Dallas, Tex., and by the Exolon Co., Blasdell, N. Y. The first of these concerns will show its new Airfloat separator for the dry separation of minerals and other materials having different densities. This machine is stated to have higher capacity and greater flexibility than earlier models and to be of all-metal welded construction. Material is stratified by air over a pervious oscillating deck which propels the heavy material forward and slightly uphill, while the light material flows backward and downward by gravity. Eighteen different sizes are available. Another new machine to be shown by this company is the Electro-Float separator for the separation of minerals and other materials having different electrical susceptibilities. This machine, which is to be announced at the Show, is designed particularly for uniform efficiency under varying weather conditions. Material is fed from a suitable hopper over a rotating cylinder which is electrically grounded. Opposite the cylinder and parallel with it are two electrodes that are connected to a high tension source of electricity. The upper electrode is composed of a row of needle points and the second is a vacuum tube to which a small amount of gas is admitted. Material delivered to the cylinder from the hopper, passes under the needle electrode which imposes static charges directly on the material, causing the particles to become more or less electrically polarized. Further rotation of the cylinder brings the material under the gas tube electrode, which attracts towards it the least polarized material. A dividing partition separates the two classes of material.

Among the new developments to be shown by the second company mentioned, the Exolon Co., is the Multi-Form Grader, which is a new development for extremely close grading at high capacity, or for ordinary screening, at greatly accelerated rate. It is a special form of suspended four-deck screen, vibrated by an offset weight method. Separations in the range from 4 to 250 mesh are claimed. One size of machine uses a deck 34x27½ in., while another smaller



**New Williams 18-ft. diameter mechanical air separator for solids**

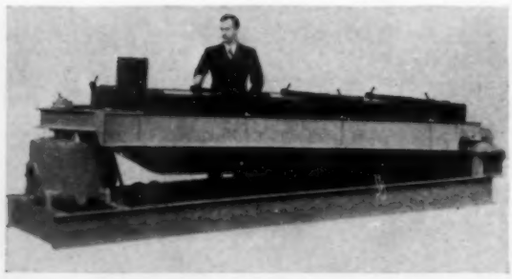
machine has half this deck area. The machine will be in actual operation at the Show.

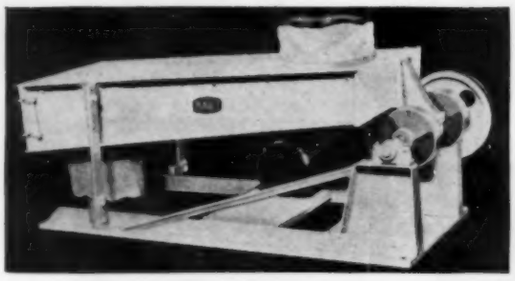
Among a variety of types of gyratory sifter to be exhibited by the Great Western Mfg. Co., Leavenworth, Kans., will be the new Style G bolter and rebolter which is designed to take care of extremely large capacities. A small operating model of this machine, which is of the reed-suspended type with eccentric weight vibrator, will be exhibited at the Show.

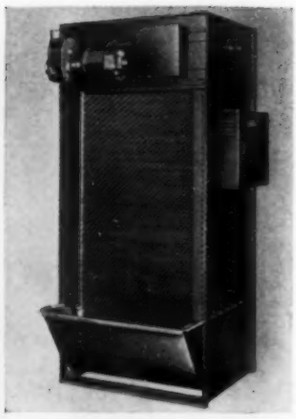
An improved mechanical air separator will be featured by the Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. This separator operates in closed circuit with a pulverizer of almost any type, the material to be classified being fed into the top of the machine and dropped on a revolving distributor plate. Material is thus sprayed into a rising air current where the finer particles rise and the coarser particles drop. Passing up through the separating chamber, the dust-laden air is given a whirling motion between spinner blades so as to precipitate any remaining oversized particles. The spinner is adjustable for fineness control. Nine sizes of separator from 2½ to 18 ft. diameter are available.

### Dust and Fume Handling

A new device known as the Electro-Matic filter, built by American Air Filter Co., Louisville, Ky., will be exhibited in operation. This device combines electrical precipitation for the removal of smoke and dust particles from air, with an automatic self-cleaning air filter which removes the larger particles. A testing apparatus will be shown, giving a continuous visual record of the dust content of the air before and after passing through the filter. An indication of the care which exhibitors are giving to forceful demonstrations of the principles of their equipment is evident in the demonstration of this company's full-size Type F Roto-Clone dynamic dust precipitator which will be shown made of Lucite. With the aid of a stroboscope, it will be possible to see exactly how the dust is precipitated on the blades of the impeller and separated from the air.







**At top is the new Rotex 82 screener and, above, the Readco vibrating sifter; the Electro-Matic air filter appears at the upper right and the new Falstrom dust gate at the right**

Dust control equipment will be featured by the Falstrom Co., Passaic, N. J. A unit dust collector known as the Dustrol will be part of this installation. This is a self-contained unit, consisting of a motor, exhauster and cloth or other type filter, as required. This company's dust gate will also be shown, a device for dust-free filling of containers from supply hoppers. This equipment, which is made in various sizes and in various metals such as aluminum or stainless steel, is equipped with a connection to a small exhausting unit to maintain negative pressure within the dust gate and prevent dust leakage. The operating handle is said to assure positive control of flow by the operator. A sponge rubber seal between the gate and the container is another feature. These devices will be shown in conjunction with a full-sized set-up of pneumatic conveying and dust handling equipment.

An interesting ventilating method for use in air conditioned laboratories will be demonstrated by the Kewaunee Mfg. Co., Kewaunee, Wis., and Adrian, Mich. This is a new style fume hood which has an air inlet as well as an exhaust, so that fumes are exhausted by means of air drawn in through the air inlet, without removing air from the room.

In order for visitors at the Exposition to see for themselves the latest improvements in this company's all-steel cloth-screen dust collectors, the Pangborn Corp., Hagerstown, Md., will have a complete operating assembly of collector and exhauster on display, equipped with glass windows and interior illumination for observation.

## DRYING, HEATING AND HEAT TRANSFER

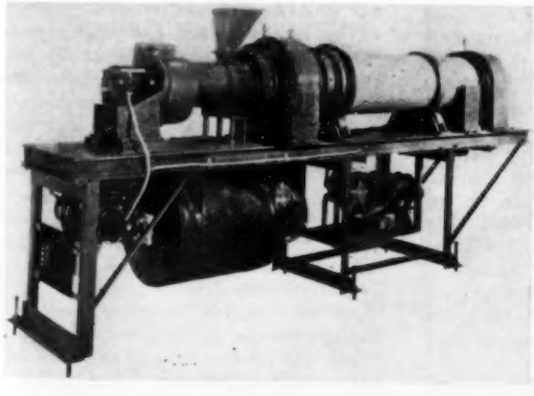
RECENTLY improved versions of two of its types of equipment will be exhibited by the Louisville Drying Machinery Co., Louisville, Ky. One of these is the Louisville Wright cord filter which, although similar in principle to earlier models, has been markedly refined in design. A new adoption of the use of this filter is in the sugar industry for filtering sugar muds where it replaces the strainer type of filter and is said to give greater clarity in the filtrate and lower sugar in the cake. The cords used can be rubberized to resist acid or made of metallic cable to withstand alkalis. Drums may be of wood, steel or any desired corrosion-resisting metal. Another piece of improved equipment is a model of this company's Type L dryer which is claimed repeatedly to have attained a thermal efficiency of 85 per cent referred to the fuel in commercial installations. This is a rotary dryer in which the hot combustion gases first pass the length of the shell through box-like structures supported from the inner pe-

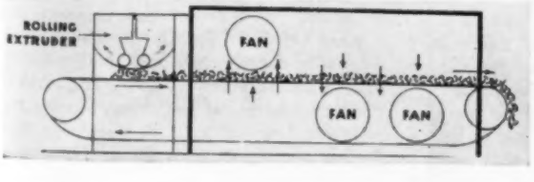
riphery. The gases then enter the shell proper and flow back through the unobstructed space in direct contact with and counter to the material.

Philadelphia Drying Machinery Co., Philadelphia, Pa., will illustrate a variety of the types of dryers manufactured, and will display a special type of cabinet tray dryer intended for making very accurate determinations of the drying characteristics of materials which can be dried in an atmospheric type dryer. This machine, illustrated herewith, is equipped with a delicate balance which weighs the material as it is dried. Both the wet bulb and the dry bulb are automatically controlled and variable speed drive is provided for the fan so that the rate of air circulation can be adjusted for best performance.

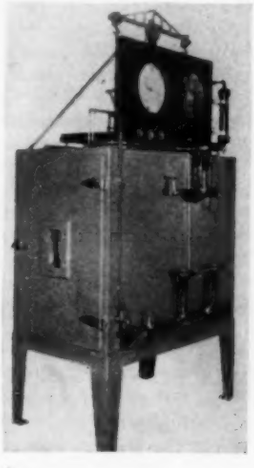
Among several types of dryer to be displayed by Proctor & Schwartz, Inc., Philadelphia, Pa., will be the most recent improvements in the Aero-Form dryer which was first introduced at the Chemical Exposition in 1935. The earliest type of Aero-Film dryer employed a pre-drying step for materials which otherwise could be dried only on trays or on trucks. This pre-drying device was an internally heated grooved drum in which the material to be dried was formed into small sticks, partially dried and then discharged to the conveyor of the main dryer. The fin drum itself has been recently improved through increased efficiency of the fingers which remove the material from the grooves and through greater compactness. A totally new form of feeding device has also been developed for the Aero-Form system and this type, known as the rolling extruder, is applicable for materials which are of sufficiently substantial consistency as discharged from the feeder to hold their extruded form without pre-drying. This new type of feed consists of a hopper which rolls back and forth over a perforated plate as it presses the material entering the hopper through the perforations and thus forms the material into equally sized particles.

Louisville Type L high efficiency dryer






At left below is a diagram of a rolling extruder on an Aero-Form dryer, and below, a special Philadelphia dryer for determining drying characteristics



### Heating and Heat Transfer

Several developments in heating and cooling equipment will be shown by American Instrument Co., Silver Spring, Md. A line of immersion heaters to be exhibited is made in two types, flexible and pipe-fitting. The flexible type, available in units up to 2,000 watts capacity, can be installed in the open top of a vessel or through the bottom or side. The pipe-fitting type, available in units up to 6,000 watts capacity, is intended for screwing into the walls of vessels. A line of open-coil electric heaters to be shown is available in sizes up to 1,000 watts per unit. These are designed for service in industrial ovens and similar equipment. For the heating of small rooms and similar inclosures, the company will exhibit electric room heaters in sizes of 750, 1,500 and 3,000 watts capacity.

An interesting design of portable cooling unit will also be shown. This device, built in three sizes of 625, 1,905 and 2,520 B.t.u. per hour cooling capacity, is intended for use in baths or tanks for maintaining the liquid temperature at or below room temperature. The unit consists of a refrigerator unit mounted in a perforated metal housing and equipped with ball bearing casters, a seamless flexible metal tubing connecting the refrigerator unit and the cooling coil, and a cooling coil and expansion valve. The only adjustment required is the temperature setting of the thermoregulator.

In its display of industrial and laboratory forced-draft, gas-heated ovens, the Despatch Oven Co., Minneapolis, Minn., plans to feature a new method of burning called "controlled combustion." By means of this feature the back pressure in the combustion chamber is said to be regulated so as to obtain greater operat-

**WILLIAM H. GABELER, general superintendent of the Davison Chemical Corporation of Baltimore, Md., gives attention here to the progress in dust control—a problem that has developed to no mean proportions in many process industries in recent years.**

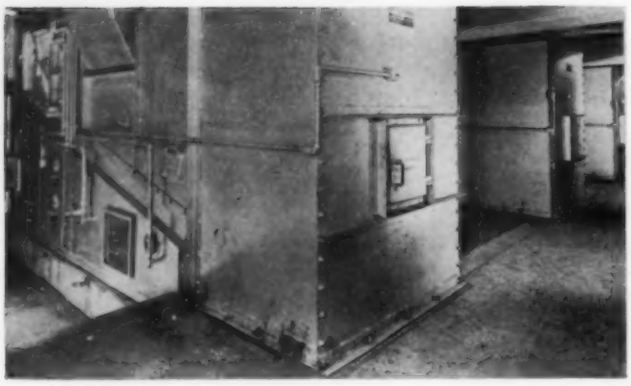
A QUARTER-CENTURY AGO, dust was dirt and usually disposed of with a broom. Today the recovery and processing of fine materials is one of the most important operations in the chemical industry. In the modern plant making sulphuric acid, superphosphate and fertilizers, almost every known type of dust collecting and dust handling system is used. Various metallurgical dusts are reclaimed from the $SO_2$ gas in the roasting of sulphurous materials with such equipment as the shelf-type collector, the highly efficient cyclones and the very effective electrical precipitators. These dusts are handled by pneumatic conveying systems of both pressure type and vacuum types.

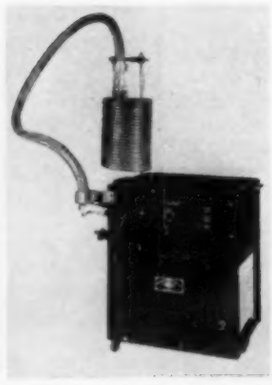
Catalysts are protected by intricate systems of air cleaning for dust removal and for ordinary temperatures the use of glass-wool filters and the felt-type of filter has proved decidedly successful.

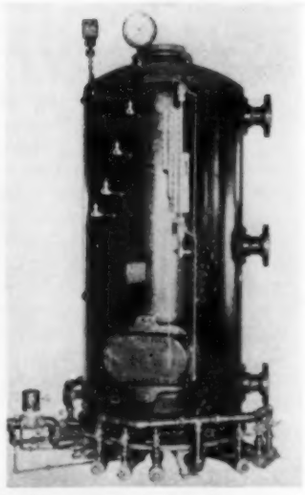
Superphosphate production requires fine grinding of phosphate rock which is then collected or separated in cyclone or centrifugal separators. High efficiency bag filters, equipped with cotton bags, collect the micron-sized dust particles from the vents of these systems. The fine rock is conveyed by screw conveyors and pneumatic conveyors to the acidulating process.

A great achievement of chemical engineering in the fertilizer industry has been the recent development of a dust-less, free-flowing, granulated superphosphate and mixed fertilizer. In the production of these materials, careful control is maintained in the classification of particle size and the dust separated from the final product is returned to be reprocessed and granulated.

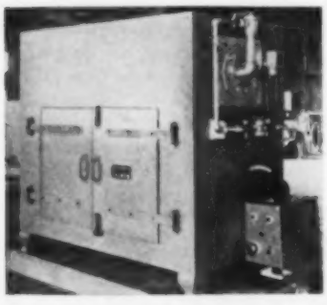
## THEN AND NOW IN PLANT OPERATION

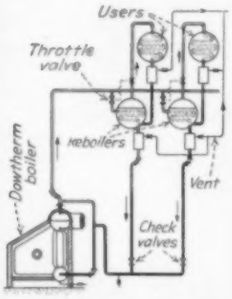




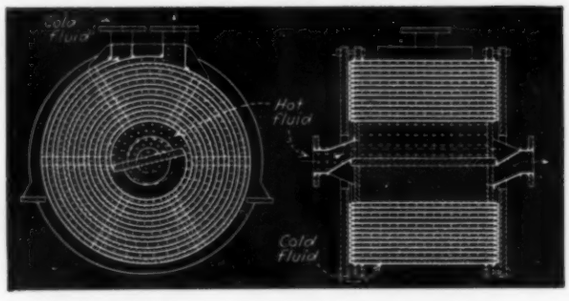


Top, left to right: Fuller inclined grate clinker cooler; American Instrument's portable cooler; McKee Dowtherm boiler






At the left is a Despatch oven with controlled combustion; and right above, a Foster Wheeler Dowtherm heating hookup for several different user temperatures




One form of spiral heat exchanger made by American Heat Reclaiming Corp.

ing efficiency. Details of the method have not yet been announced but will be demonstrated at the Show. It is claimed that this new method eliminates odors from improper combustion.

The McKee Dowtherm gas-fired boiler, which has emerged from the experimental stage since the last Chemical Exposition, is one of the developments to be shown by the Eclipse Fuel Engineering Co., Rockford, Ill. This boiler is available in 28 sizes from 15,000 to 1,000,000 B.t.u. hourly output. Such boilers are recommended by the manufacturer for heating jobs in the range between 300 and 650 deg. F. where an indirect vapor-phase heating medium is desired. Designed especially for gas fuel, the boilers have small, long tubes for the gas to keep the flue gas temperature to a minimum.

This company is also exhibiting a series of new automatic atmospheric gas burners known as Eclipse Gas Guns. Four types are available covering a range from 300,000 to 1,200,000 B.t.u. output per hour. A "Junior" line extends the range down to 175,000 B.t.u. per hour. The unit receives all air through a quiet-operating blower mounted on top of the control box. Control of ignition and burner operation is accomplished through a flame-actuated relay. The unit is fully automatic, is stated to be quiet in operation and suitable for locations requiring absolute cleanliness.

The feature of the exhibit of the Foster Wheeler Corp., New York, will be a demonstration of the advances that have been made recently in Dowtherm vapor heating. A Foster Wheeler Dowtherm vapor generator will be shown, together with diagrams of various applications of this heating method for high temperature processing work in various industries. A number of the newer methods of using Dowtherm revolve around means of producing different temperatures in different units of processing equipment with the same Dowtherm boiler. One of these methods which is illustrated herewith employs a reboiler for each using application. The reboilers produce Dowtherm vapor at the desired temperatures by means of Dowtherm vapor at higher pressure received from the vapor generator. The rate of admission of high pressure vapor to each reboiler governs the amount and temperature of the vapor produced in the reboiler, this rate being controlled automatically by the temperature of the low-pressure vapor in the user. Thus each system is absolutely independent and avoids any possibility of inadvertent flooding of the surface during the throttling which would otherwise be necessary to secure the reduced temperature.

Its new inclined-grate cooler for portland cement clinker will be one of the featured developments to be shown by the Fuller Co., Catasauqua, Pa. This cooler is roughly similar in appearance to an inclined-grate stoker. It is simple mechanically and requires relatively little space. The primary cooler consists essentially of a brick chamber below, and either in line with or at right angles to, the kiln. Clinker drops upon grates where it forms a substantially flat, inclined bed which is moved at a uniform rate to the discharge. The grates are water-cooled and consist of fixed elements alternating with reciprocating elements. The cooling air passed up through the grates flows to the kiln combustion chamber to serve as secondary air.

The booth of the Goslin-Birmingham Mfg. Co., Birmingham, Ala., will feature the American Heat Reclaiming Corp.'s spiral heat exchanger which is manufactured by the Birmingham concern. One type of such heat exchanger is shown in the accompanying cross section. This development, introduced recently from Europe, represents a type of equipment employed for several years in European pulp and paper mills and sugar refineries. The exchanger is built up of two spiral plates spaced one within the other so as to form two spiral passages, one for the hot and the other for the cold fluid. Parallel-, counter-, and cross-flow types are available.

Among the types of unit heater to be shown by the Grinnell Co., Providence, R. I., is the new automatic Thermolier which incorporates a 60-deg. adjustable built-in thermostat with day setting for comfort heating and night setting for building tempering. A hydraulic action

bulb type thermostat is employed. The day and night settings are obtained by pull cords which can be reached from the floor.

An improved type of burner for industrial furnaces will be featured by the Selas Co., Philadelphia, Pa. This is known as the Duradiant burner and is claimed to insure uniformity of heat distribution, simplified furnace construction, better atmosphere control and operating economy. A high proportion of the total heat produced by the burner is supplied in the radiant form, according to the manufacturer. The burner itself is a radiating surface, in the form of an incandescent cavity in contact with which the gas fuel is burned. This principle of combustion is stated in some cases to have reduced the size of the furnace installation enough to eliminate 40 per cent of the brickwork.

## ELECTRICAL AND POWER TRANSMISSION EQUIPMENT

An entirely new principle in adjustable speed alternating current motors will be shown by the Louis Allis Co., Milwaukee, Wis. This company's new Ajusto-Spede motor is a combination of an eddy current clutch and a standard constant-speed a.c. squirrel-cage motor. There is no mechanical contact between the driving and driven members of the unit, the speed and torque variations being obtained by controlling the magnetic excitation of the clutch, thereby giving any desired slip. Through this system, it is said to be possible to accelerate loads quickly or gradually, to permit rapid intermittent starting and disconnecting of the load and to absorb torsional impulses and vibrations. Speed variation between zero and full speed at full load torque may be obtained. Continuous operation at low speeds is said to produce no overheating.

This company will also feature a new line of explosion-proof and totally-inclosed motors which have been completely redesigned. Both types are fan-cooled, with a number of similarities in construction.

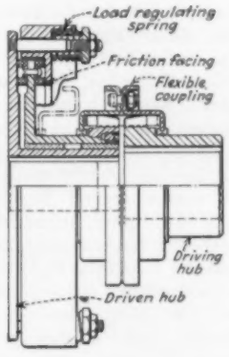
Two new power transmission developments will be shown by the Falk Corp., Milwaukee, Wis. One of these is known as the Controlled-Torque Coupling and its purpose, as described by the manufacturer, is to act as a mechanical circuit breaker and shock absorber for the protection of mechanical equipment. This device combines in one unit a standard Falk flexible coupling and a friction clutch which is loaded by springs and can be adjusted to deliver any maximum torque up to the full capacity of the device. Under instantaneous high peak load, the clutch slips and so protects the connected machinery. Another new development is an improved right-angle, vertical-type speed reducer for driving overhead equipment such as conveyors or equipment beneath the reducer, such as an agitator. The low-speed shaft can be extended either downward or upward. Both double and triple reduction models are available, with a total range of reduction ratios from 5.7 to 1 to 515 to 1.

Among the lighting devices to be exhibited by the General Electric Vapor Lamp Co., Bloomfield, N. J., will be various forms and sizes of the new fluorescent lamps. These tubular light sources generate ultra-violet radiation within the tube by means of a mercury vapor arc. This radiation in turn causes fluorescence of a coating within the tube and so produces visible light at high efficiency, about three times as much light per watt, for example, as an incandescent lamp.

A new development of the Philadelphia Gear Works, Philadelphia, Pa., to be shown by that company, is the Plane-Torque MotoReduceR, a new drive designed to protect all types of driven equipment from damage caused by overloading. This device is a motorized speed reducer incorporating an automatic power shut-off. As soon as the excessive load is removed, the unit is ready to start without resetting. The new overload protection device can be supplied for horizontal or vertical drives in all horsepowers and ratios. It operates as follows: Whenever excessive torque is imposed on the output shaft, the increased torque required to rotate the planet gears mounted on the output shaft spider transmits a higher torque to an internal gear which is held in normal position by a lug and heavy spring. When the torque on the internal gear exceeds a predetermined value, the torque spring is compressed, thus actuating a switch and disconnecting the power.

Indicative of the increasing use of

**Right—Falk controlled-torque coupling**
**Below—New Louis Allis Ajusto-Spede a.c. motor**




## THEN AND NOW IN PLANT OPERATION

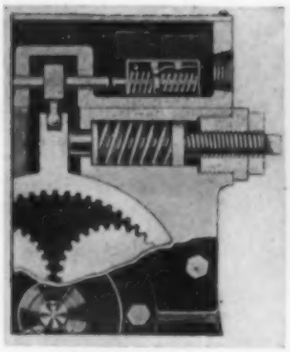
**R. P. DINSMORE left M. I. T. in 1914 to join Goodyear's Experimental Department at Akron. After serving as chief chemist and chief compounder at Canadian and California plants, he was appointed assistant to the factory manager in 1932 in charge of new products development.**

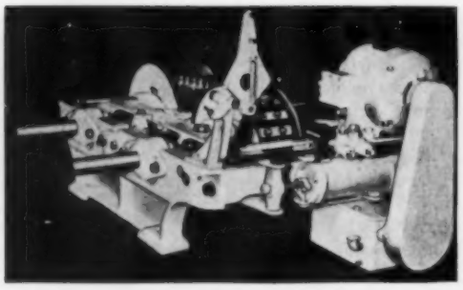
TWENTY-FIVE YEARS AGO the importance of analyzing plant operations on a unit-process basis was appreciated by only a few advanced thinkers, largely confined to the strictly chemical industry. In spite of the highly specialized development of certain unit operations, such as distillation, modern chemical engineers have applied these principles with marked success in a still wider range of industry. Their efforts have been greatly aided by superior equipment and more highly standardized materials now universally available. A better understanding of the importance of catalysis, effected both by intentional and inadvertent impurities, has been of great influence in the development and control of processing.

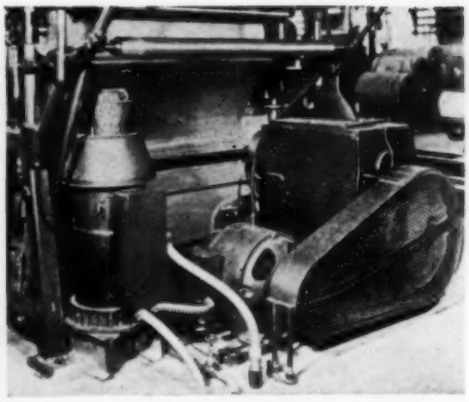
In the rubber business *per se*, the transfer of heat and the intimate mixing of rubber with reactive materials might be considered the outstanding unit operation. In the past 25 years these operations have been transferred from a cut-and-try basis to relatively scientific methods by which vulcanization and mixing are accomplished in greatly reduced time and with adequate certainty of uniform results.

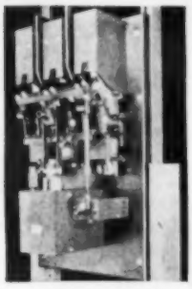
In special branches of the rubber industry, such as the manufacture of latex goods, and in reclaiming, other unit operations such as drying, filtering and grinding, have undergone corresponding developments.

It is apparent that the chemical engineer has come into his own and that the speed of his progress in late years has been greatly accelerated not only by extensive research but also by the increasing liberality displayed in the publication of his results.

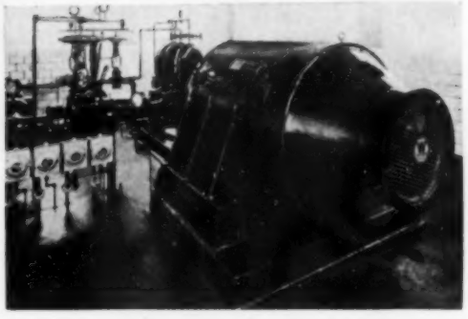








Above is Philadelphia Gear's new torque limiting device, and right above, a Reeves hydraulic speed control; at the right are the Stephens-Adamson Saco speed reducer, and an electrically operated Westinghouse De-ion circuit breaker of high capacity



Right top—Reliance all-electric variable speed drive

Right bottom—New 500-hp. Westinghouse explosion proof motor

transparent plastics for show models, to permit observation of operating principles, is the fact that the Reeves Pulley Co., Columbus, Ind., will show a standard Reeves transmission made of Plexiglass. In addition there will be a number of new developments in variable speed control. One of these is an automatic remote control for use with the Reeves Vari-Speed Motodrive. The new control operates on fluid pressure and consists of a bellows shifting mechanism for speed change mounted on the Motodrive. The other new control is also hydraulic, and is employed with the standard Reeves variable speed transmission. This device is a self-contained hydraulic power unit, comprising a small electric motor operating an oil pump in a reservoir. Oil supplied by this pump is used to apply pressure to one side or the other of a piston operating in a cylinder which serves to position the shifting levers of the transmission. A two-way valve which may be mechanically controlled in any desired way from the driven machine then controls the flow of oil to the cylinder.

Its new all-electric, variable-speed drive will be the featured exhibit of the Reliance Electric & Engineering Co., Cleveland, Ohio. This system, in effect, employs a special design of motor-generator operating on alternating current to generate direct current which is supplied to a Reliance Type T d.c. motor designed particularly for adjustable speed service. Control elements consist of push-buttons and a rheostat for speed changes. A practically infinite number of speeds within an over-all speed range as great as 12 to 1 may be secured with this equipment. Another recent development to be shown by this company is its line of larger explosion-proof d.c. motors which are now being built as large as 75 hp. These motors are inclosed and fan-cooled and equipped with ball bearings. They comply with the requirements of Class 1 Group D hazardous locations.

Stephens-Adamson Mfg. Co., Aurora, Ill., will show several new types of power transmission equipment. Among these is the new Sealmaster ball bearing pillow block and flange unit which features a positive centrifugal labyrinth oil seal to protect the bearing from dust and dirt and retain the lubricant. Another new development is the Saco speed reducer, a recently announced type which has as the first reduction stage a V-belt and as the second stage, a set of helical gears. In this type of reducer, the motor is customarily mounted directly on the reducer.

Considerable new electrical equipment will be featured by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Included will be new types of explosion resisting motors which are now being built in ranges all the way from ¾-hp. single-phase motors for compressors, pumps, blowers, etc., to 500 and 1,000-hp. motors with self-contained, self-lubricated bearings. Numerous new types of control equipment will be shown. Among these are improved oil-immersed explosion-resisting, De-ion circuit breakers for circuits up to 600 amp. at 600 v.; electrically operated De-ion breakers for 600 v., 6000 amp., a.c., or 750 v., 10,000 amp. d.c. service; manual De-ion starters with automatic overload protection; and compensated thermal-trip, oil-immersed De-ion breakers for 15–50 amp., 250 v. a.c. Improved lighting units will also be shown including new industrial concentrator lights for lighting horizontal and vertical surfaces from an oblique angle. These last employ an aluminum reflector, cast aluminum socket housing and heat resisting lens.

## FLUIDS HANDLING AND PUMPING

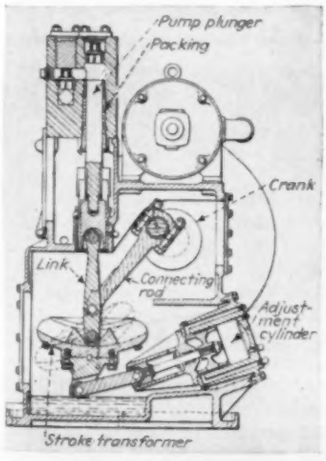
THE PRINCIPAL feature of the booth of the Aldrich Pump Co., Allentown, Pa., will be a 2½x3¾ in. model of the Aldrich-Groff "Powr-Savr" controllable-capacity, vertical, triplex, reciprocating-plunger power pump. The unit consists of a power end totally inclosed and automatically lubricated by a pressure system, a fluid end on top of the power end, so arranged as to prevent any liquid being pumped from contaminating the lubricating oil, or vice versa, and a control mechanism. Setting of the latter may be either manual, remote manual or automatic.

The pump is provided with a decidedly novel method of delivery control which permits discharge at any rate between zero and a maximum. The accompanying cross section shows that the pump plungers are driven by means of a link, a connecting rod and a rotating crank. A device known as a "stroke transformer" converts the fixed throw of the crank motion, which is transmitted to the link, into an oscillating and reciprocating motion of the latter, the reciprocation being of any desired magnitude from zero to a maximum. In the position shown in the drawing the pump stroke is zero. Tilting the stroke transformer causes reciprocation, the magnitude of which

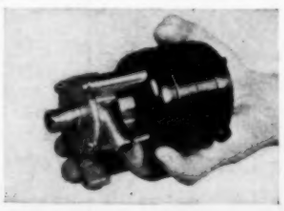
depends upon the amount of tilt. Either mechanical or hydraulic means for tilting the stroke transformer can be used.

A type of pump used elsewhere for a number of years, but new to the chemical industry, is the Bump pump made by the Bump Pump Co., LaCrosse, Wis. This pump is made in sizes from ½ to 200 g.p.m. capacity and is equipped for direct, V-belt or variable speed drive in stationary or portable models. Both sanitary and industrial types are built. The pump is of a novel self-priming positive type for a wide range of viscosities, with bearings at either end of the two shafts supporting the pumping elements, separated by stuffing boxes from the contents of the pump. The pumping elements are two identical half-moon shaped elements which rotate in close juxtaposition to a stationary sealing element, in the center of each pumping chamber, and the figure-of-eight casing.

Part of an operating exhibit of the Corning Glass Works, Corning, N. Y., in combination with other industrial glassware, will be the new Nash-Corning glass centrifugal pump which is built by the Nash Engineering Co. Although the pump has only glass in contact with the liquid being pumped, it is available in a single size with a capacity up to 6,000 g.p.h. against 70 ft. total head. Pyrex brand glass is the material used. The pump casing is made in two parts, inclosing a glass impeller. The casing is held together by spring pressure applied to an inclosing, protecting cast iron structure in such a fashion that excess pressure may be released by the springs. Quick demountability for cleaning, and a unique stuffing box with acid-proof seal, are important features of the design. Hot acids such as hydrochloric, or brine-cooled liquids, may be pumped with equal facility, according to the manufacturer.

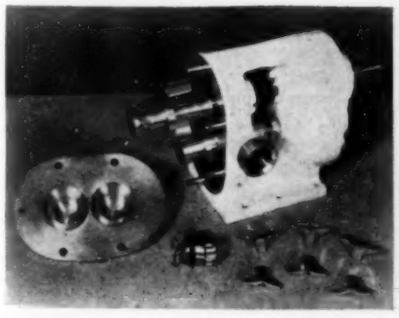


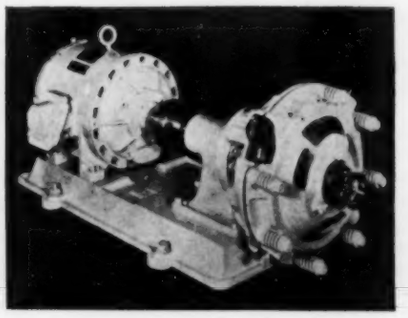

Among the new equipment to be exhibited by the Duriron Co., Dayton, Ohio, will be a new line of streamlined centrifugal pumps which are stated to have increased efficiency and new refinement of the stuffing box. The new pumps, which are produced in Duriron, Durichlor, Durimet and other stainless steels, are made in sizes from 1 to 6 in. inclusive and in capacities up to 2,000 g.p.m. Details of the new construction will be withheld until the Show. The same is true of a new special acid-proof joint for high-silicon iron pipe which is to be available in all commercial sizes.



**At the left is the Aldrich-Goff controllable capacity plunger pump, below it a disassembled Bump pump; at the left is the midget Eastern centrifugal pump, and at the bottom the Nash - Corning Pyrex glass centrifugal pump**

Two models of a miniature close-coupled centrifugal pump built in Monel metal, stainless steel or other alloys as specified, will be shown by the Eastern Engineering Co., New Haven, Conn. Model A equipped with an a.c. motor of 0.01 hp. has a capacity of 2 g.p.m. against 10 lb. maximum pressure. In the d.c. type, the capacity is 6 g.p.m. against 12 lb. maximum pressure. Model B, available in both a.c. and d.c. types, has a capacity of 8 g.p.m. against 20–30 lb. maximum pressure.





Among the equipment to be shown by Henry E. Jacoby, New York, is an entirely new design of duplex diaphragm pump, which is motor-driven, with neoprene diaphragms hydraulically actuated. The liquor chambers can be fabricated of any castable metal. Simplicity of design, and rapid and easy cleaning, are said to be outstanding features. The accompanying drawing gives an idea of the construction of the pump. A motor direct-connected to a worm drive immersed in oil drives a hydraulic piston

## THEN AND NOW IN PLANT OPERATION

**T. G. DELBRIDGE, manager of the Research and Development Department of the Atlantic Refining Co. of Philadelphia, has been in a unique position to mark the advance of chemical engineering progress and equipment in the petroleum industry during the past quarter of a century.**

THE PAST QUARTER CENTURY has brought revolutionary changes in petroleum refining—changes due to the demand for sixteen times as much gasoline and the necessity of processing six times as much crude oil to meet a continuing sharp increase in the severity of product specifications. Distillation continues to be the major unit operation. Destructive distillation, or cracking, barely recognized in 1914, actually creates about one-half of our present gasoline production. In other refining processes, many advances have been made. The principal chemical process of 25 years ago, sulphuric acid treatment, has been to a considerable extent replaced in lubricating oil refining by solvent extraction and in gasoline refining by vapor-phase solid adsorbent treatment. Polymerization, hydrogenation and improved catalytic and thermal cracking are all outstanding.

An interesting measure of progress is found in changes in equipment, design and operation. Four aspects deserve emphasis: (1) change from batch to continuous operations, particularly where large volumes of material are handled as in distillation; (2) truly amazing increase in size and complexity of processing units permitting lower selling prices for the products; (3) precise and usually automatic centralized control of operations as to temperature, pressure, flow rates, etc., thus making possible the operation and control of the large units as well as better and more uniform product quality; (4) far greater safety due to better materials of construction, improved design whereby smaller volumes of petroleum are subject to high temperatures and pressures at any given instant, and finally, more adequate fire prevention equipment and methods.

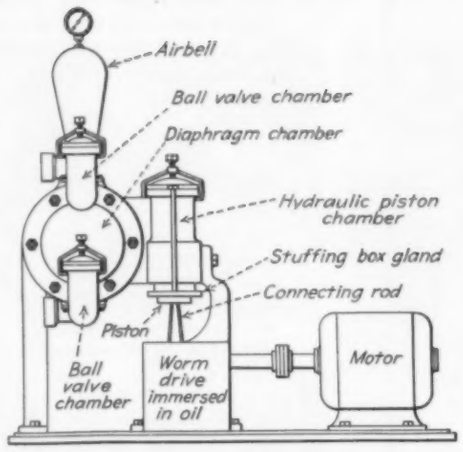
through a connecting rod. Pressure from the system is thus transmitted hydraulically to the diaphragm which is thereby caused to reciprocate.

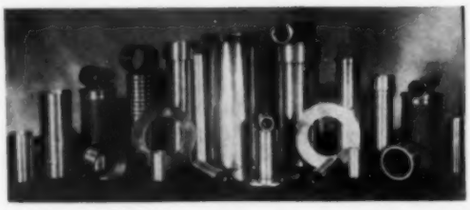
Another new development is a sight flow glass known as the "Full-View." The glass opening has a diameter equal to the inside diameter of the pipe, or larger. A small flapper indicates flow and gives some idea of the flow rate. Available sizes range from ½ to 4 in. i.p.s.

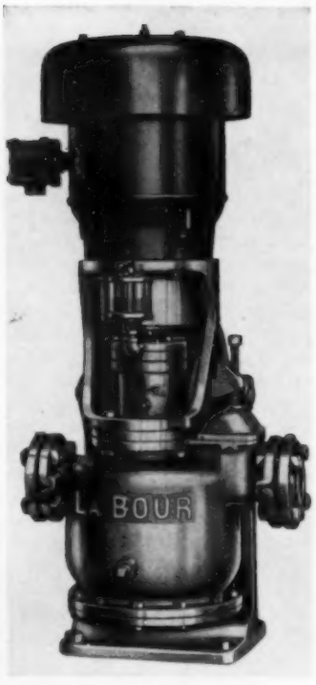
Janney Cylinder Co., Philadelphia, Pa., a manufacturer of cylindrical parts for pumps including shaft sleeves for centrifugal pumps, liners for reciprocating pumps, wearing rings, impeller rings, etc., all of which are fabricated by centrifugal casting, will show in addition to a complete line of such parts in various corrosion-resisting alloys, its newest developments in Supard-Chrome steel, a heat-treated, hardened, stainless steel for wear, corrosion and heat resistance, having a hardness of 550 Brinell; and in Worthite, an alloy developed specifically for severe corrosion in chemical plant pumps.

An entirely new self-priming centrifugal pump for chemical and hydraulic service, designated as Type R, will be exhibited by the LaBour Co., Elkhart, Ind. With the exception of lead, the new pump can be built in practically any machineable metal or alloy. One of the most original features is the mount of the pump. When operating, the pump is in a vertical position. However, through the use of a special pivoted mount, the pump may be turned up into a horizontal position when it is desired to gain access to its interior. The impeller, which is of the open type, is the only moving part. There is no packing gland and no mechanical seal. Instead, the driving shaft is sealed by liquid, the shaft passing through a special removable and replaceable sealing housing which, without mechanical contact during either shutdown or running, entirely takes the place of all mechanical seals. The self-priming feature is an extension of the principle used in this company's earlier pumps and is said to produce performance characteristics formerly considered impossible. The air capacity of the new pump is claimed to be tremendously increased over that of older pumps of the same hydraulic size rating. A dry vacuum under test often exceeds 27 in., while the pump reaches the maximum vacuum in from ½ to ⅒ the time of older pumps. Owing to these characteristics the maker recommends the pump particularly for pumping tanks and tank cars, draining sumps and for chemical tower service.

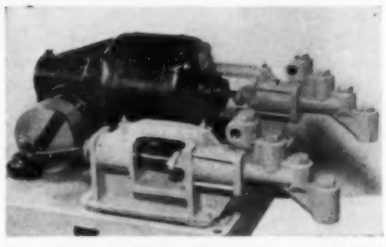
The Milton Roy Pump Co., Philadelphia, Pa., will exhibit six new chemical pump models, developed particularly for the accurate pumping of chemicals in any desired volume against pressures ranging from 0 to 15,000 lb. per sq.in. All of the pumps shown are motor-driven units, some with one and some with two cylinders, driven by the same gear-motor. All are provided with accurately adjustable stroke and with a featured type of






**Top—Jacoby hydraulic diaphragm pump**
**Above—Various Janney alloy pump parts**



**Top—New LaBour Type R centrifugal pump**
**Above—Milton Roy duplex chemical pump**

## THEN AND NOW IN PLANT OPERATION

**DAVID E. PIERCE, chemical engineer, with Charles Lennig & Co., at Bridesburg, Philadelphia, has had wide experience in the design and operation of chemical engineering equipment in the heavy chemical industry. Here are his views on progress of the past quarter of a century in the field of fluid flow.**

THE CHEMICAL ENGINEER responsible for the selection of equipment for handling and transporting fluids—both liquids and gases—in modern plants, has much greater latitude of choice than he had twenty-five years ago. For pumping he is no longer limited to the older reciprocating or centrifugal pumps, but can choose from a variety of positive-pressure rotaries (screw, gear, eccentric rotor, lobe, etc.); turbine-type; diaphragm (reciprocating or rotary); accurate proportioning; close-coupled centrifugals and those without stuffing boxes as well as several equipped for self-priming. These are now available in materials of construction formerly seldom used, such, for example, as nickel, Monel, aluminum, stainless steel and other alloys, rubber and synthetic materials similar to rubber, plastics, glass and stoneware.

Instead of brass, lead, steel or cast-iron pipe, he can transport his liquids in tubing or pipe of the same material as his pump. For valves, also, he can specify a variety of materials resistant to corrosion, heat and high pressure and can choose from new designs which include lubricated cocks, diaphragm valves, etc. His piping can be assembled with "welded fittings" to reduce friction and leaks as well facilitate erection. The pumps can be installed in a hazardous location because of the availability of explosion-proof motors and switches. Finally, he can insulate with magnesia, glass wool, aluminum foil or vermiculite. He can paint his lines with chlorinated rubber, synthetic resins or sprayed metal, and can measure the rates of flow with rotameters, variable-orifice constant head meters, or old venturi and orifice meters with modern long-range indicating and recording devices.

double ball-check valve on both the inlet and outlet, comprising in each case two ball-check valves in series. This design, according to the manufacturer, assures maximum efficiency of displacement. The ball checks are arranged for automatic discharge of air and small particles of dirt and are claimed to make the pump literally self-cleaning. Various construction materials are available for various corrosive services.

A new development in fittings, valves and tubing will be introduced at the Chemical Exposition by the Tri-Clover Machine Co., Kenosha, Wis. These fittings have been developed particularly for use with light-gage tubing rather than conventional iron-pipe-size tubing. Lines using these fittings are stated to be easily disassembled for cleaning. Fittings machined inside are available where absolute cleanliness is necessary. This company will also show the Tri-Clover centrifugal pump, a novel type employing a screw-shaped impeller which is stated to be non-agitating and non-foaming, designed to handle not only clear liquids but also liquids containing semi-solids. These pumps are available with either sanitary or iron-pipe connections.

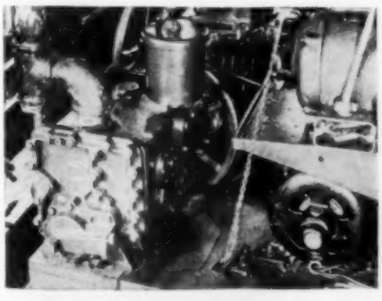
### Vacuum Pumps

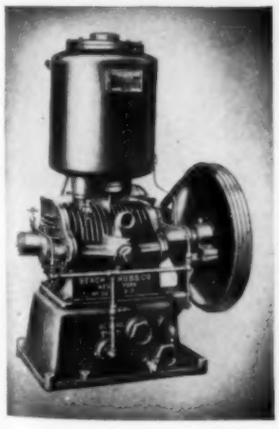
An improved high vacuum pump known as Type RP will be shown by the Beach-Russ Co., New York. For wet vacuum operation, this pump operates to within 50 microns of absolute on closed suction, the manufacturer claiming a much higher volumetric efficiency for wet chemical processes than has before been available in other types of pump. In concentration or distillation of high boiling compounds, vacuum of ½ mm. of absolute is claimed. On dry vacuum operation, maintenance of a pressure within 10 microns or less of absolute is claimed for closed suction tests. The pump is of the rotary oil-sealed type with automatic lubrication and special means provided for separating water or condensate from the oil. Only two moving parts are used.

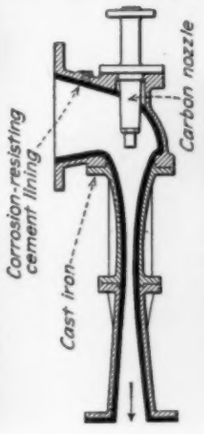
A feature of the exhibit of the Croll-Reynolds Engineering Co., New York, will be an acid-resisting-cement-lined steam jet Evacfor, or ejector, with the steam nozzle made of carbon. The design of the equipment is such that only the cement or carbon comes in contact with the fluid being handled, so that it can be used successfully with extremely corrosive vapors and gases. An important feature is that the cement surface is even smoother than the pipe itself, which contributes to the efficiency of the outfit. The manufacturer suggests such uses as on vacuum concentrators for sludge acid, and on stills for organic materials where such corrosive agents as hydrochloric acid may be present.

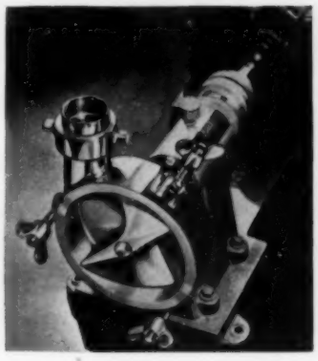
Two new designs of rotary vacuum pump for the production of extremely high vacua will be exhibited by the Kinney Mfg. Co., Boston, Mass. Both are production size pumps and both are claimed by the manufacturer to be the first pumps of the mechanical type, outside of small laboratory models, which are capable of producing vacua far below one micron. Tests in the factory are stated to produce vacua generally as low as 0.06 microns, while on production work in the evacuation of special electronic tubes and certain types of lamp, they are claimed to produce consistently vacua of 0.1 to 0.2 microns. In another single-stage vacuum pump shown will be a new type poppet valve said to be especially suitable for chemical work. Another new development is a vacuum-tight valve intended particularly for use in high vacuum lines. According to tests such valves have shown a leakage reduced to a calculated value of $7 \times 10^{-9}$ cu.ft. per second, according to the manufacturer.

The Motoair pump will be a featured new development of the New Jersey Machine Co., Hoboken, N. J. This device, a







**At left is a Kinney high vacuum pump and below it a Beach-Russ Type RP; a Croll-Reynolds cement lined ejector appears at the left and below, a Tri-Clover pump**

**CLARENCE G. DERICK, consultant, of Sewaren, N. J., eye-witnessed the early struggles of our American dyestuff industry. Since leaving National Aniline and Chemical Co. in 1921 he has operated a number of inorganic, as well as organic, chemical industries.**

## THEN AND NOW IN PLANT OPERATION

THROTTLED by the absence of any tariff which would protect the American standard of living and allow a sufficient share of profit to be plowed under in the productive field of research, the dyestuff and organic chemical industries of this country supplied only about 10 per cent of our 1914 needs. Such a sorry situation naturally did not attract the interest and intelligence necessary to improve the operating equipment. Cast iron, steel and lead had to satisfy where cheaper but more absorbent wood could not be used. Rarely were rubber, enamel, aluminum, or nickel employed.

The World War by creating the most effective tariff wall imaginable, allowed the sorely needed profits and we emerged from the beehive coke-oven stage of these industries into the modern by-product method and scale of operations. Stainless steel and alloys demonstrated their value. American enterprise exploited the dormant German development of plastics and Haveg equipment came into use, largely eliminating metallic contamination and the absorbed impurities of wood. Where better heat exchange was essential, tantalum heat exchangers and linings came in to replace lead and other metals. Then followed the development of dense structural carbon with better heat conductivity than steel and complete resistance to most acids. And this was the period that produced Pyrex as an industrial material of construction.

Manufacturers of chemical engineering equipment have readily adopted these new materials and so improved their design that the 1939 units for dyestuffs and organic chemicals, with their modern automatic and indicating control accessories often bear little relation to those museum pieces of 25 years ago.

**F. C. HETTINGER, superintendent of U. S. Industrial Chemicals, Inc. of Baltimore, is an engineer who had his pre-war schooling with Merrimac. Starting in plant operation as a foreman with U.S.I. he is now superintendent in charge of manufacturing a wide variety of chemical products for which distillation is the most important unit operation.**

PROGRESS in operating distilling equipment during the past twenty-five years has been one of gradual improvement. As more basic data become available for design and operation of stills, it has been necessary for operators to know more about the distilling problem than most other unit operations.

Distillation under increased or reduced pressure is readily accomplished. The basic data again point the way to the designer and operator in predetermining the type and method of operation. The separation of binary mixtures was undertaken and accomplished in 1914 and prior, but now the separation of ternary mixtures is finding a place in many plant operations.

Side-stream removals or additions to a column are found very helpful in making clean separations. The feeding of a plate on a column with liquid or vapor is more generally understood than it was 25 years ago. Workmen in plants doing distillation work seem very anxious to learn the function of distilling equipment and since a great deal of information is available in the literature, it can sometimes be used by non-technically trained as well as technically trained personnel.

In addition to the chemical engineer who designs the equipment, a great deal of credit should go to the electrical and mechanical engineers who are now furnishing the industry with automatic and recording instruments. The precision work that can be accomplished with the use of such accessories is amazing to the man who spent years in trying to get along without them.

## THEN AND NOW IN PLANT OPERATION

combined pump and motor in one integral unit, is designed to operate under either pressure or vacuum. The pump is equipped with automatic lubrication and an air filter, and may be mounted in any position. Capacities of 2.5 to 70 c.f.m. of free air are available.

### Pipe and Valves

Important in the exhibit of Farwell Metal Fabricating Div. of Farwell, Ozmun, Kirk & Co., of St. Paul, Minn., will be a line of light-gage, large-diameter fabricated alloy pipes and fittings in sizes from 3 to 10 in. Pipe is ordinarily furnished in 10-ft. lengths with Van Stone ends and loose flanges. Available fittings include 45- and 90-deg. elbows and tees. Several types of stainless steel, Monel, nickel, Inconel, Everdur, and other alloys are used.

A comprehensive line of corrosion-resisting alloy valves and fittings for the handling of various corrosive fluids used in the process industries will be exhibited for the first time by the Crane Co., Chicago, Ill. Both valves and fittings will be available in various alloys for different corrosive services. Among the materials used are chrome-nickel-molybdenum steel, Monel metal, nickel and silicon bronze. Valves and fittings are available with screwed ends in sizes from ¼ to 2 in. and valves, in gate and globe patterns, with flanged ends from 1 to 4 in. inclusive.

One important new development to be shown in the booth of the Grinnell Co., Providence, R. I., is the new model H-14 Genspring constant-support hanger for pipelines subjected to high temperatures and considerable temperature variations. The design of this hanger is such that the support is always constant and equal to the weight of the piping, irrespective of thermal movements of the pipe due to temperature variations in service. It is claimed by the manufacturer that this is the first spring hanger designed specifically for this service and capable of providing proper support. The hanger compensates for variations in spring tension so that its supporting effort cannot vary.

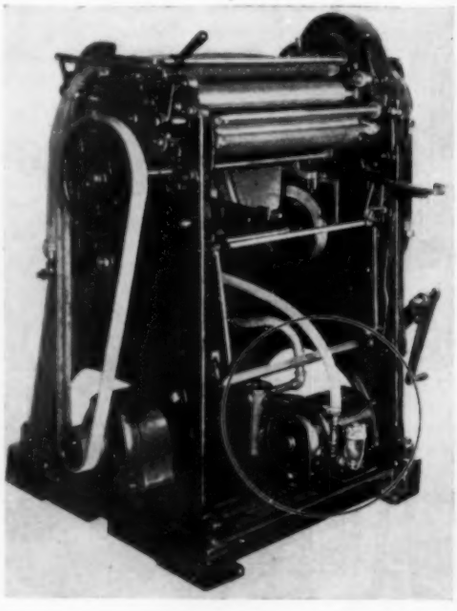
For plant scale use where small flows of fluids are encountered, and for semi-works plants and laboratory use, Hoke, Inc., New York, will show a new series of high pressure regulators and a new line of alloy valves for both throttling and on-and-off service on gases and liquids at pressures up to 2,000 lb. per sq.in.

The new No. 500 series of high pressure reducing valves is available for maximum delivery pressures of 550 and 1,000 lb. These regulators are stated to be easy to use and to adjust. All are supplied with relief valves of the spring-loaded type to protect the instrument against excessive downstream pressure. Although originally designed particularly for dead end service, they are conservatively rated for flows as high as 50 cu.ft. per hour.

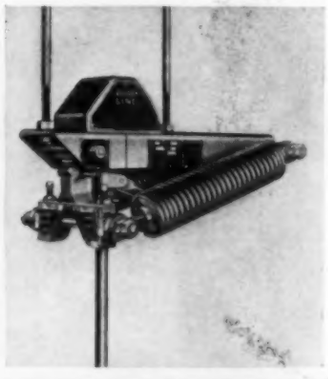
The new alloy valves, which are made for ⅛, ¼, and ⅜-in. pipe sizes, are intended for both corrosive and non-corrosive liquids and gases. A new design of spindle and packing system is their novel feature. The spindle is described as "full-floating," a feature which is said to yield a valve in perfect alignment. Both blunt point stems for shut-off service and V-point stems for throttling are available. The valves are machined from 18–8 steel with the exception of certain portions made from 14 chrome hardened steel or 18–8 stainless with hardened Hastelloy C insert. Both straight through and angle patterns are available.

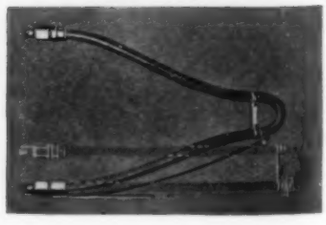
A new development to be shown by

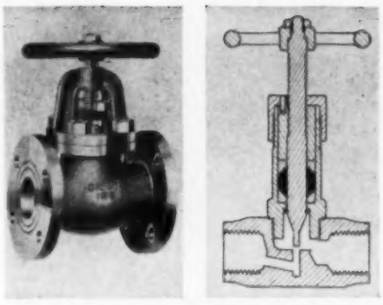
**A New Jersey Machine Co. Motoair vacuum pump is shown below installed on a label gumming machine**



**Below is a Genspring constant support pipe hanger, and below that, a Packless self-draining platen press connection**







Left—New Crane stainless globe valve
Right—Hoke high pressure alloy valve

the Packless Metal Products Corp., Long Island City, N. Y., is a new line of seamless flexible metal hose made in steel in sizes up to 2 in. i.d. Heretofore, this company's flexible metal hose has been made almost exclusively in high-tensile bronze. A new type of swing-joint will probably be exhibited at the same time. One recent development of the company is a vibration absorber for isolating the vibration of compressors. This consists of a piece of seamless bronze tubing drawn into a helical flexible tube with plain straight-end extensions provided for connecting to standard piping. Still another new development is a self-draining flexible metal hose connection for platen presses. A flexible spring arm attached to this loop of flexible metal hose holds the hose always in such position as to assure drainage regardless of movement of the platens.

A line of ground glass spherical joints for plant and laboratory use will be shown by Ace Glass, Inc., Vineland, N. J. Such joints at present are available only in sizes up to 25 mm. bore of the glass pipe. The joints employ a ball and socket type of connection, providing flexibility and ease of lining up.

A newly developed ammonia unloading system will be exhibited by the Blaw-Knox Co., Pittsburgh, Pa. The Marlo Co., New York, will demonstrate new types of packings constructed of special materials for use on all types of acids excepting acetic. Excellent results on sulphuric and hydrochloric acids are reported by the manufacturer. Other types of packings for food products which cause undesirable reactions with ordinary packings will also be shown. Finally, Sarco Co., New York, will show a wide variety of traps including two recently developed models. One is a straight-through inverted bucket trap to simplify piping installation, the other a 900-lb. inverted bucket trap with body and cover of steel forgings, secured together by special alloy steel bolts. Stainless steel interior parts are used, together with a special hard stainless alloy for the renewable seat and disk.

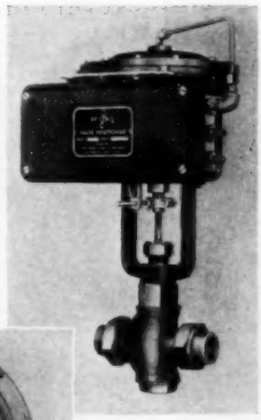
## INSTRUMENTS AND CONTROL EQUIPMENT

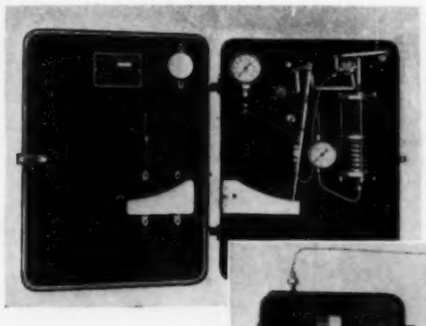
AMONG the instruments to be shown by the American Meter Co., Erie, Pa., is the recently developed Metric air-actuated remote controller and recorder. This instrument consists of a transmitter which is placed at the point of measurement of pressure or flow, and a receiving instrument which is placed at any desired remote point, such as in the control room. A single length of seamless tubing connects the two instruments. In the transmitting end is a pilot valve actuated by the measuring means which controls the pressure on a spring-loaded bellows. Change in pressure in the bellows causes rotation of the body of the pilot valve in a direction opposing the primary change. Therefore, for every primary indication, a definite pressure exists in the bellows. This pressure is transmitted to an identical bellows in the receiving instrument which therefore assumes a degree of expansion identical with that in the sending instrument and so reproduces the primary indication.

Restyling of its complete line of meters for industrial processes and power plants will be featured by the Bailey Meter Co., Cleveland, Ohio. Another important new development of this company which is to be exhibited is the new cracking control system based on yield per pass and *in situ* density. This system is said to provide close control of the finished products of petroleum cracking, to permit operation at increased capacity, to in-

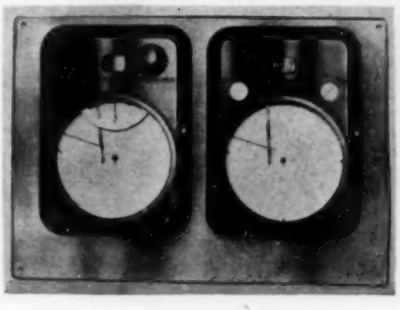
New Brown recording thermometer

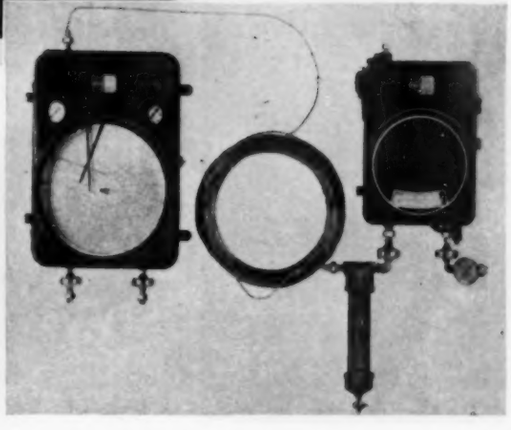
Left—Bristol pneumatic valve positioner
Below—American Meter remote transmitter





Lower row, left to right: Buffalo Meter Co.'s Electricontact meter; Bristol flow ratio controller; and Bristol's Metavane pneumatic transmission system





crease time efficiency and to result in increased thermal efficiency. This development employs a hook-up of standard Bailey equipment.

A considerable number of newly developed control instruments will be exhibited by the Bristol Co., Waterbury, Conn. Among these developments is a new valve positioner which is a pneumatic mechanism designed to position the disk of a diaphragm control valve at the exact point called for by the control instrument, regardless of valve friction. The device is operated by changes in air pressure from the controller and it, in turn, regulates the pressure of an independent air supply to the diaphragm motor of the valve. Another new development is the company's Metavane system of pneumatic telemetering. Through this system temperature, flow, pressure and liquid level can be recorded, indicated or controlled at a remote point. The transmitting instrument employs the primary indication to set a device which is essentially one of this company's free-vane pressure controllers. This device then controls the air pressure in the line to the receiving instrument which is a standard pressure recording gage calibrated in terms of the particular variable being measured. The company also plans to show new recording and automatically controlling pH potentiometers. These instruments employ the glass electrode method of measurement.

The company's new Ardometer radiation pyrometer for indicating, recording and controlling will be shown. This is a device which is sighted upon a hot object within a furnace, the radiation being concentrated by means of a lens upon a glass-protected thermocouple. The e.m.f. developed by the thermocouple is measured by a potentiometer or millivoltmeter pyrometer which may be mounted at any desired location. A flow ratio controller recently announced by the company will also be exhibited. With this instrument the rate of flow of one fluid can be controlled in a definite ratio to the flow of a second fluid.

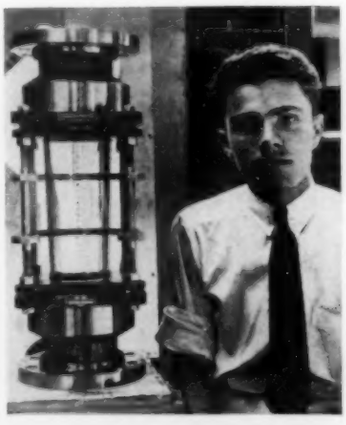
Other new developments of the Bristol Co. include a recording voltmeter of portable design; the Thermoverter, a device making possible the measurement of a.c. electrical power using any potentiometer or millivoltmeter as the measuring instrument; and a carrier-current system of telemetering of electrical quantities, whereby these quantities may be recorded at any distance up to several hundred miles from the point of measurement.

Brown Instrument Co., Philadelphia, Pa., will display a new and improved line of temperature, pressure, flow and liquid level recorders, indicators and controllers featuring newly designed cases. This company will also show its pneumatic control transmission system for the transmission of temperature, pressure, flow and liquid level meaurements to a remote point. This last system is stated to be particularly suitable for hazardous locations where the use of electricity for measurement transmission is not desired. This company's multiple-recording potentiometer pyrometer controller, another recent development said to be the only instrument of its kind on the market, will be exhibited. This instrument both records and controls from two to six temperatures from as many different thermocouples.

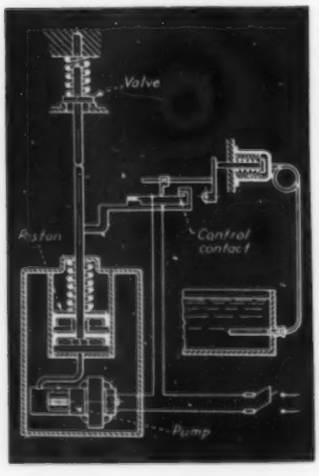
A device known as the Niagara Electricontact meter for automatic control of liquid handling operations, will be shown by the Buffalo Meter Co., Buffalo, N. Y. The feature of this meter is that it permits automatic shut-off of the flow without any attachment to the meter which would interfere with accuracy or life of the meter. Operation is by closing or opening an electrical circuit after passage of a predetermined quantity of liquid through the meter. Any desired construction materials may be employed in the 14 available sizes of meter.

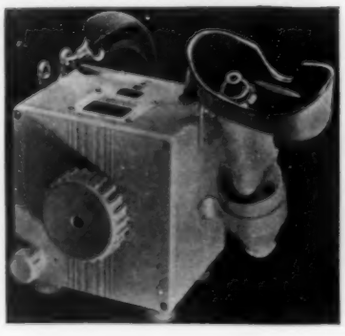
Among the temperature and gas-measurement instruments to be shown by Charles Engelhard, Inc., Newark, N. J., will be the new all-quartz cell for this company's analyzer for corrosive gases. The gas being measured comes in contact only with quartz. The instrument is of the thermal conductivity type, the platinum spirals being protected with quartz

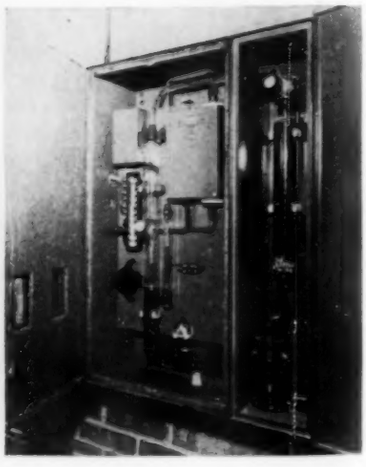
**At right are Foxboro's improved potentiometer pyrometer and remote flow transmitter; and below, an example of the largest diameter Fischer & Porter rotameter**



**Bottom row, left to right: Sarco Type SE temperature controller; Fischer & Porter Series 300 rotameter; and Leeds & Northrup's new potentiometer type optical, and improved sulphur dioxide recorder**







and sealed in quartz tubes. In order to secure proper heat transfer, the complete quartz unit is imbedded in a metal block. Measurements on wet sulphur dioxide, chlorine and hydrogen sulphide are among the suggested applications.

The current Chemical Show is the first at which machine-made, precision-bore, interchangeable Pyrex glass tubes for rotameters will have been displayed. Fischer & Porter Co., Philadelphia, Pa., has developed such a process on a production basis and tubes produced by this method will be demonstrated graphically to prove their claims of precision. Several new instruments using these tubes will be shown. One of these is a totally new design which has recently been worked out in collaboration with a number of leading chemical manufacturers. This instrument is a post-type rotameter with removable tube and safety float stop. As shown in cross-section, it is designed to facilitate float removal and permit thorough cleaning while incorporating draining features to assure complete drainage. Enlargement of the inlet and outlet openings to decrease friction loss is another feature, as are improvements in stuffing box design which separate the stuffing box entirely from the body casting. This new line of instruments is known as Series 300.

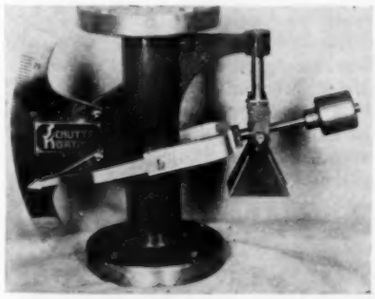
The Foxboro Co., Foxboro, Mass., will show three new types of pyrometer recorder-controller. Included among the new developments are pyrometer throttling controllers and cycle controllers. Three new types of remote transmission instruments are also available for measurement and control, at a distance from the point of indication, of such variables as flow and liquid level.

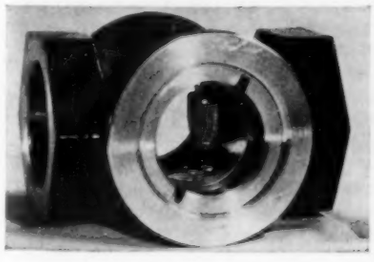
General Electric Co., Schenectady, N. Y., will show the new Reactrol system for the temperature control of electric furnaces.

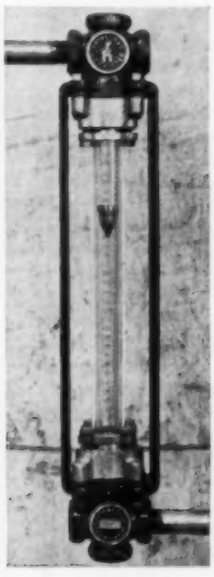
Among the new instruments to be exhibited by Leeds & Northrup Co., Philadelphia, Pa., will be an improved $SO_2$ recorder or controller, a new optical pyrometer and a new instrument for use with the dropping-mercury electrode. In the new $SO_2$ instrument, an entirely new combination of filter and gas analysis cell is used. The filter is claimed to be extremely efficient and to require no attention. The cell is entirely glass-coated inside, presenting no exposed metal. With this instrument, the $SO_2$ damper may be operated either pneumatically or electrically, whereas in the past only electric control was available. The optical pyrometer, said to be entirely new, is claimed to be the only potentiometer type optical for industrial use. It is calibrated in degrees and its optical system is more readily sighted than the older L & N instrument. The third instrument, the Electro-Chemograph, produces an ink-drawn curve from a Micromax pyrometer. In recording the current and potential relationships of the dropping-mercury electrode the instrument is stated to be an extremely promising device for qualitative and quantitative analyses. This type of electrode, which may be visualized essentially as operating in a plating bath of the unknown solution, accomplishes analysis in terms of a predetermined calibration by producing a curve which reaches a succession of points at which the elements being analyzed will, so to speak, "plate out." The recorder draws a curve of potential against current.

Sarco Co., New York, will show a working model of its new type SE self-contained electric temperature regulator. This temperature controller is actuated by a fluid-pressure sensitive system which controls the electrical circuit to a small motor-driven pump. The pressure produced by this pump is used to open the valve which is normally closed. A system of linkages and switches causes the valve to float at the proper throttling value, through alternate stopping and starting of the motor. Another new temperature regulator is the Type TR-40 self-operated

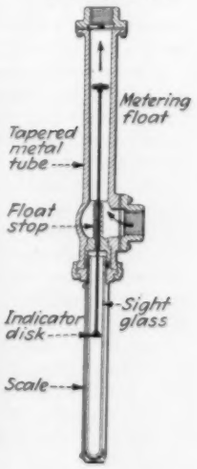
**Below and at right are Schutte & Koerting's new magnetic and Universal rotameters; and at bottom, the Jacoby sight flow indicator**







**Selas Co.'s Flo-Scope meter for gas measurement**




## THEN AND NOW IN PLANT OPERATION

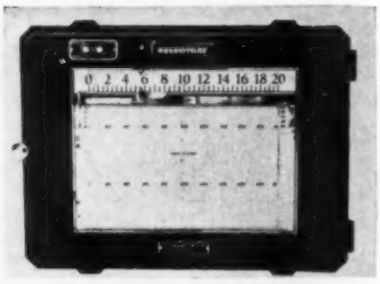
**DANIEL S. DINSMOOR, plant manager for Monsanto Chemical Co. at Monsanto, Ill., served his pre-war apprenticeship with Merrimac at Woburn. Since 1920, he has been in production work in charge successively and collectively of a wide variety of manufacturing operations in chemical industry. His views here cover a broad range of operations and processes.**

COOPERATION of technical men in the process field with technical men in the equipment field has made possible rapid progress in the design of chemical engineering equipment. For most unit operations, equipment is available today which is far superior both in productive capacity and in freedom from breakdown, which means lost production time. Automatic control of such factors as temperatures, pressures and rates of flow was a theoretical blessing and a practical headache to the operating man of 1920. Today we have available in increasing number reliable automatic controls which can do a better job than can be done by the constant attention of an operator. These controls have the further advantage of being operated from remote points, a most important factor in the current trend towards outdoor plants with the instruments in central control houses.

We are fast getting away from the old chemical plant which was housed in an expensive building and which, in turn, necessitated the addition of awkward side structures and superstructures to accommodate alterations and expansions. These changes have been steadily bringing about a radical change in the type of worker employed, resulting in a very marked increase in the number of skilled employees and a substantial decrease in heavy manual labor. We should not fail to note, furthermore, that the chemical industry which was regarded as a particularly hazardous type of operation 25 years ago has today far better rating with respect to accident prevention than many of the old basic industries that had attained their majority at a time when chemical industry was a mere infant.

Wheelco potentiometer and thermometer controllers

At right, Taylor's new varnish thermometer



Upper right—Two new Tag Celectrays: a recorder controller and a multipoint indicator; right, Industrial Instruments' Solu-Bridge

cooling water control for air compressors, condensers, and internal combustion engine jackets. This automatic regulator adjusts itself to feed the minimum amount of cooling water required at all times, according to the manufacturer.

Several new variations of the rotameter fluid meter will be exhibited by Schutte & Koerting Co., Philadelphia, Pa. One of these is a new universal rotameter in which the pipe connections and frame are in one piece as compared with the eight pieces used in the old pillar type. This design is rigid to eliminate strains and the tube can be inserted and taken out of the frame without disconnecting the pipe line. This construction permits 16 different connections with the same instrument. A novel variety of rotameter which has been developed for use on opaque liquids and with high pressures where glass cannot be used, employs a non-magnetic metal tapered metering tube in which is a float having an iron core. A counterbalanced magnet outside the tapered tube carries a pointer indicating on a scale. Thus, the magnet follows the rotor and indicates its position and hence the rate of flow.

The Selas Co., Philadelphia, Pa., will show an interesting flow indicating instrument intended particularly for use on fuel gas. This instrument is a meter of the area type employing a vertical tapered metal tube through which the gas flows, beneath which, out of the gas flow, is a sight glass in which an indicator disk is visible. A metering float is connected by a rod to the indicator disk.

In the booth of the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., many new models of Celectray pyrometers and resistance thermometers will be shown for the first time. These instruments are characterized by the use of a beam of light reflected from a mirror galvanometer instead of the customary galvanometer boom or pointer. Among the new Celectrays is an indicating potentiometer controller of the self-balancing type, designed to indicate temperature on a 10-in. scale. Such applications as hydrogen-ion control are suggested for this type. A new recorder-controller for throttling electric heat is of the on-off type. The operation and construction of this recorder are similar to other of the company's potentiometers except that by reciprocating the control contacts, throttling regulation of electric heat is obtained. Still another new instrument is a multi-point self-balancing indicator available in three types. In the fastest operating model the indicator can cross the 10-in. scale in 10 seconds. The instant of achieving balance is indicated by a signal light. These instruments can be switched to any desired number of points.

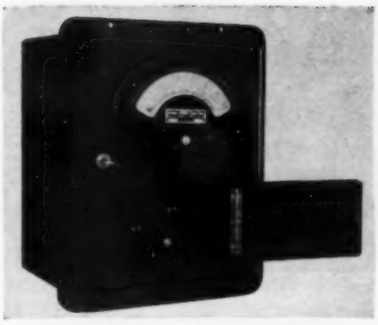
A variety of improved instruments for temperature, pressure, flow, liquid level and humidity will be shown by the Taylor Instrument Cos., Rochester, N. Y. An entirely new instrument is a fume-sealed varnish thermometer designed to avoid the condensing of vapors on the glass and scales of the thermometer when used in gum melting, oil boiling and varnish cooking. The new design is stated to keep out all fumes and vapors and so to eliminate periodic cleanings of the tube and scale. This company's Binoc thermometer tube construction is employed to give twice the usual angle of visibility.

A considerable number of new instruments will be demonstrated by Wheelco Instruments Co., Chicago, Ill. Two of these instruments employ this company's electronic capacity actuating principle which eliminates moving parts such as depressor bars, cams, motors, etc. One is the Series 3200 potentiometer controller which employs the capacity control effect in combination with a potentiometer to give instantaneous control action. Another instrument is an indicating control thermometer for temperatures up to 1,000 deg. F. which combines the capacity control mechanism with a fluid-actuated sensitive system. A new recording thermometer of the fluid-fill type, for temperatures to 1,000 deg. F. will be shown together with a new dial indicating thermometer of the mercury, gas-filled or vapor-actuated type.

### pH and Conductivity

A variety of improved pH meters, including a new low-cost meter of portable, rugged and simple construction which does not employ a glass electrode, will be shown by the Coleman Electric Co., Maywood, Ill. Among the instruments to be displayed, is an automatic recording and controlling glass-electrode pH meter comprising three units: an amplifier and cell chain housed together, a power pack, and any one of several standard recorder controllers. The glass electrode permits continuous flow of the sample. An automatic warning device is provided to signal if any part fails to function properly.

New a.c. operated instruments to be exhibited by Industrial Instruments, Inc., Jersey City, N. J., include the Solu-Bridge, a self-contained conductivity bridge for determining the concentration of NaOH by electrical conductivity. To test a given solution the dial is rotated until a cathode ray "eye" opens to the maximum value which indicates the balance point. At this point the concentration of the solution is directly indicated on a scale. Another new conductivity instrument is the automatic distilled water checker, series DW. This instrument is

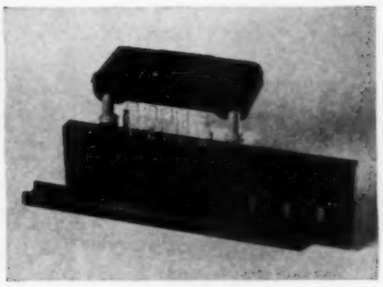


Two new Beckman pH instruments, the automatic and the industrial models

generally employed with the conductivity cell permanently installed in the pipe line carrying distilled water or other electrolyte to be tested. Any increase in conductivity above normal results in the operation of an alarm signal, electric valve or other desired control apparatus. A third new instrument, the Model RC conductivity bridge, is a Wheatstone bridge adaptation which is portable, self-contained and easy to use. Like the first instrument described, the balance point is indicated by an electronic "eye."

Several improvements in pH instruments have been developed by the National Technical Laboratories, Pasadena, Calif., since the last Chemical Exposition. The Beckman automatic temperature-compensated pH indicator provides completely automatic pH indication, control and recording, using the glass electrode. The instrument operates on standard 115 volt a.c. circuits, compensating automatically for voltage fluctuations. A shielded, rugged electrode of the flow type for accurate operation up to temperatures of 212 deg. F. is ordinarily employed. A controller mechanism and any standard recording potentiometer may be added to the instrument. Another recent development is an industrial pH meter which, although not automatic, is stated to be easily worked by any operator. A sealed and shielded glass electrode, a continuous pH indicator and a dual scale for ample separation between dial points are features. An improved laboratory meter features built-in temperature compensation, automatic sensitivity control and a sealed glass and saturated calomel electrode.

The entire line of slide comparators to be shown by W. A. Taylor & Co., Baltimore, Md., has recently been redesigned. These instruments are used for general pH and chlorine control and for control of phosphates in boiler water. They are molded entirely from plastics and are small, compact, readily portable and clearly engraved in white.



W. A. Taylor's new pH comparator

### Other Instruments and Scales

An interesting reflux control for use in pilot plant and semi-works distillation units made of glass will be shown by Ace Glass, Inc., Vineland, N. J. This device consists of a pivoted glass funnel having a soft iron insert which is suspended in the distilling head. An electromagnet outside the distributing funnel chamber, operated by a synchronous electric time switch, causes the funnel to tilt at intervals so as to discharge the reflux outside the condenser. Practically any reflux ratio may be maintained with this device.

Among the various measurement and control instruments shown by American Instrument Co., Silver Spring, Md., will be a variety of types of thermoregulator for temperatures ranging from 0 to 540 deg. F., equipped with pipe threads for insertion in pipe lines, tanks, etc. These are of the direct reading type, designed to maintain temperature to plus or minus 0.2 deg. F. Another instrument to be shown by this company is the Magne-Gage, a magnetic instrument for determining the thickness of coatings on metals. By means of this non-destructive test it is possible to measure the thickness of magnetic metals plated on non-magnetic base metals, non-magnetic coatings such as metals or enamels on iron or steel, or nickel coatings on iron or steel. The accuracy is said to be about plus or minus 10 per cent.

Several newly developed instruments for plant control work will be shown by the Brabender Corp., Rochelle Park, N. J. Among these is an automatic recording viscosimeter which is suggested for use in work on oil, printing ink, latex, glue and similar products. This company's hardness tester, also to be shown, measures and records the hardness of such materials as clay, slate, pitch and activated carbon. The Plastograph measures and records the consistency of a wide range of materials from fairly viscous to such substances as unvulcanized rubber. It has been used with such materials as fertilizers, paints, plastics, tar and asphalts and is provided with various types of agitator, water jacketed for temperature control. The plasticity is "weighed" as indicated in the accompanying illustration. Still another instrument to be shown is a semi-automatic moisture tester,

## THEN AND NOW IN PLANT OPERATION

**T. C. ALBIN, chemical engineer since 1927 for Forest Products Chemical Co. of Memphis, Tenn., has had long experience in wood distillation. Here he reviews the advances of that unit operation as they are reflected in that industry.**

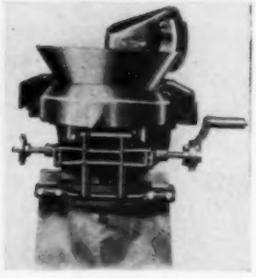
IN THE LAST TWENTY-FIVE YEARS the problems to be met in the routine day-to-day operation of most distilling equipment have been decreased in number while, at the same time, the remaining ones have been greatly simplified by the wider application of measuring and controlling instruments. In the old days breaking in stillmen was quite expensive because most of their training consisted in finding out what not to do in order to avoid making mistakes. Even so, there were relatively few good ones because only a limited number displayed the intuitive judgment which was necessary for good operations under conditions when important variables affecting the process were rarely measured and seldom under accurate control. Naturally the efficiency of the operation and the quality of the product depended almost entirely on the "human element."

Instruments are now available which will, if properly used, measure, record and control any significant condition affecting the distillation process. As a result, optimum operating conditions can be more readily established and, once established, can be maintained indefinitely. The supervisor of a process can take time out now to think about improvements or to devise better methods of doing things and still have a complete and permanent record of every detail of the operation for every hour of every day. Formerly he was continually busy checking up on every move that had to be made. Thus, turning out a uniform product to meet close specifications no longer has to be a matter of guesswork or the result of good luck.

combining a drying oven and analytical balance. The instrument is said to be suited to routine control.

Coleman Electric Co., Maywood, Ill., will also exhibit its new Regional Spectrophotometer, an instrument by which any transparent fluid may be examined by monochromatic light from any desired region of the spectrum, to determine the degree of color absorption of the fluid for that wave length. The instrument employs a light of absolute uniformity which is focused on a narrow slit in a sealed optical system which produces a normal spectrum in the plane of the exit slit. The slit permits the selection of any 30 millimicron band. Light from the selected region passes through the sample liquid and the unabsorbed light falls on a photocell. By comparison with a standard, the per cent transmittance is then measured. A complete absorption curve may be determined in approximately 20 minutes.

Several new or improved scales for production weighing will be exhibited by the Exact Weight Scale Co., Columbus, Ohio. Among these is a new corrosion-proof scale of the end-tower type, developed especially for compounding purposes in chemical plants. The alloy housing is made as moisture-proof as possible. An oil-spray system operated by depressing a plunger conducts a stream of oil to all working parts, thus avoiding the drag which would be introduced by a constant oil pool. Capacities up to 15 lb. can be handled. A new design of this company's Shadowgraph scale will be another exhibit. This scale is built in several different types and is claimed to approach laboratory accuracy in production weighing. Sizes up to 3 lb. capacity are available. The scale eliminates mechanical indication and the possibility of parallax by light-beam indication on a frosted glass chart. Another very recent development is the Dustite bag holder for use on sacking scales, with which the entire bag opening is completely closed and held tight in one operation. The bag is held fast against a spout and the dust tight feature secured by spring-loaded plates which seal the bag ears.

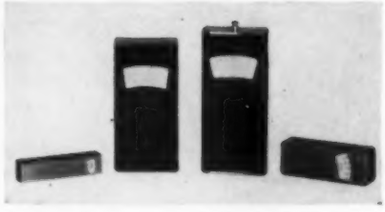


Above— Brabender Plastograph

Left—Dustite bag holder

Below — Illinois Testing Lab.'s ferrous metal detectors

Top—American Instrument Magne-Gage
Above—Exact Weight Co.'s corrosion-proof scale for chemical use



Several new instruments will be exhibited by the Illinois Testing Laboratories, Chicago, Ill. Among these is a new non-indicating pyrometer controller which operates directly from a thermocouple. A new pocket-size instantaneous direct-reading air velocity meter is another new development on which detailed information will not be available until the show. A third instrument recently brought out by this concern is the new ferrous metal detector, several models of which are shown in an accompanying illustration.

A new development of the Monarch Mfg. Works, Philadelphia, Pa., is a simple portable viscosimeter developed particularly for field tests on fuel oils, but undoubtedly of application in other work where an instrument for measuring viscosities up to 150–200 S.S.U. is applicable. A carrying case and full equipment are provided.

F. J. Stokes Machine Co., Philadelphia, Pa., will exhibit an improved type of McLeod pressure gage for high vacuum measurement, which is readily portable and is said to eliminate any danger of breakage or spilling of the mercury. A single reading can be taken in 2 to 5 seconds and continuous readings made in rapid succession simply by turning the gage from a horizontal (evacuated) position to a vertical (reading) position. Pressures from zero to 5,000 microns can be measured.

## THEN AND NOW IN PLANT OPERATION

**GEORGE E. WALKER, chemical engineer, Warner Company, DeVault, Penna., got his first plant training under Henry Howard at Merrimac and later at Grasselli. Subsequently he has been identified with other industries, including pigments production of which he writes in the short article below.**

VERY FEW good white pigments were available a quarter of a century ago and extenders such as "whiting" were considered satisfactory when bolted through 200 mesh. In contrast today, particle size below one micron with distribution within extremely narrow range in this order is common practice for huge tonnage sold on even lower unit cost basis. Controlled feeding and precipitation with accurate knowledge of optimum concentration-time-temperature conditions permit the maintenance of final pigment qualities which were then unknown or perhaps occurred only infrequently in answer to fervent prayer.

Lithopone, then just developing, yellowed in spite of added bluing and before the advent of the O'Brien process turned dark under sun exposure. Titanium, at least for the writer, was just a rare element which turned up in bauxite used to make alum and was conscientiously determined colorimetrically on all car samples. The oxide was often described as a dark yellow or brown powder. Today, it is turned out in plants of 100-ton daily capacity as a brilliant white pigment of hiding power exceeding all others and with specific qualities completely controllable.

Twenty-five years ago the necessary equipment could not have been assembled because suitable construction materials and adequate control instruments had never been developed commercially. Acid recovery, fume control, wet milling and classification were talked about, but like the weather, nothing was done. Hydraulic and centrifugal classification, micro-milling at 19,000 r.p.m. and colloidal grinding on a tonnage scale were still around the corner—dreamed about but certainly unseen.

ALLEGHENY LUDLUM STEEL CO., Pittsburgh, Pa., expects to exhibit a new type of stainless steel "lumber" produced by its Ludlite Division, Watervliet, N. Y. This new product, Ludlite Bord, consists essentially of a thin sheet of 18-8 stainless steel permanently bonded to an inert synthetic mineral backing material to form a strong, rigid panel of convenient building size. The backing material consists of asbestos fibers, bentonite, portland cement and calcined magnesite processed under high pressure and bonded to the stainless steel by means of a special pressure-cementing process. In addition to its corrosion resistance, the material contributes high heat reflectivity and thus has thermal insulating value. Standard size panels are 2x4 ft. and 2x8 ft., and thicknesses ⅛ and ¼ in.

Platinum-clad plymetals have recently been perfected by Baker & Co., Newark, N. J., and will be shown at the Exposition. The material is furnished in sheets with platinum on either one or both sides, in wire form, and in tubing with platinum on either the outside, or the inside surface, or both. Owing to this development, the manufacturer points out that it is now possible to employ platinum in contact with corrosive agents in large size equipment at comparatively low cost.

Its recent application of thin stainless steel for process industries equipment will be featured by the Edward G. Budd Mfg. Co., Philadelphia, Pa. Stainless steel buckets, duct-work, tanks, dyeing spools, screens and other units produced by this company's "Shotweld" process will be displayed, together with an operating demonstration of the "Shotweld" machine. This machine releases a controlled "shot" of high amperage, low voltage current through sheets of stainless steel between the welding tips, to produce a sound weld which is cooled so rapidly that carbide precipitation cannot take place. Hence, stainless steel so welded is not subject to inter-granular corrosion. The welding machine records each weld on a moving tape so as to give a visual check of the quality of the weld. An enlarged animated display will explain visually what happens when a weld is being made. In addition to examples of welded stainless steel construction, the exhibit will demonstrate various methods employed in reinforcing different sorts of structures made from light-gage stainless steel.

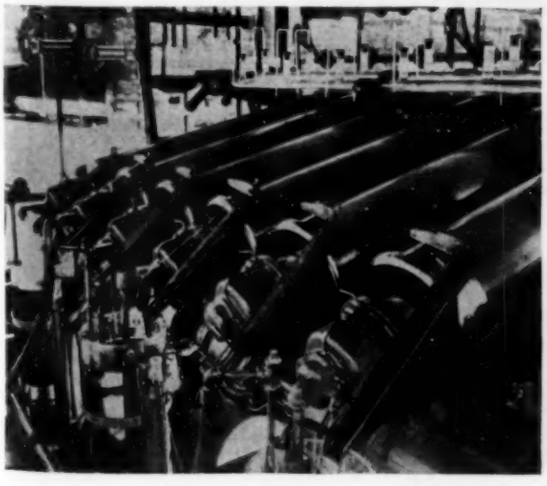
One development to be displayed by H. L. Bullock, New York, is the Master metal spray gun developed by the Master Metal Spray Co., of Oakland, Calif. This gun, known as the Speedmaster, features a special type of control valve for the air and gases which is said to reduce maintenance and eliminate backfire. Other maintenance-reducing features are emphazised, together with bath lubrication of all moving parts. The unit is said to spray any metal available in wire form. A 4½-lb. hand model and a heavier model for lathe mounting are available.

The principal new feature of the exhibit of Ingersoll Steel & Disc Div. of Borg-Warner Corp., Chicago, Ill., will be a full explanation of this company's procedure for lining large tanks, vats, bins, etc., with IngAclad stainless clad steel sheets. Particular attention will be paid to layout, welding, methods of bridging riveted or welded seams, and similar features of construction. Emphasis will be laid upon the fact that both old and new steel tanks may be lined in this manner to produce a tank of stainless steel interior at low cost.

International Nickel Co., New York, will exhibit a large number of products made from nickel and nickel alloys including the most recently developed alloys of this line, K Monel and Z nickel. K Monel, a high strength heat-treatable alloy, is stated to be of use in such applications as pump shafts, and valve disks and stems for high-temperature steam lines. Another use recently developed is for corrosion-resisting ball, roller and other types of bearings exposed to corrosive attack. Z Nickel, the other new alloy, is said to combine the corrosion resistance of nickel with the mechanical properties of heat-treated steel, having a strength from 2½ to 4 times that of ordinary structural carbon steel when heat treated. Available forms include hot and cold drawn rods, cold drawn wire and cold rolled strip. A new type of knit metallic tower packing made from nickel will also be displayed in an absorption set-up designed to show its efficiency.

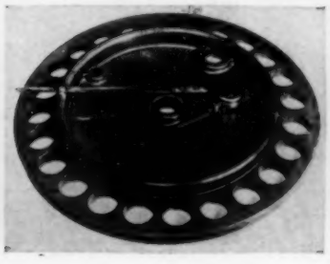
Along with its nickel-clad steel which was previously introduced, the Lukens Steel Co., Coatesville, Pa., will exhibit Inconel-clad steel and Monel-clad steel which have been developed by this company and introduced since the last Chemical Exposition. The new developments

**Right—Sheet of platinum-clad steel made by Baker & Co. Extreme right—Manner in which tank seams may be covered in lining with IngAclad stainless clad steel. Below—Cuprammonium rayon machine showing Budd stainless steel construction**



**Right—1,200 gal. process vessel of Lukens Inconel-clad steel**

**Below—American Hard Rubber's new cover for Vorce cells**



**JOHN M. BIERER, factory manager of the Boston Woven Hose & Rubber Company, Cambridge, Mass., has had thirty years of active participation in the production of mechanical rubber goods. Much of this experience has been concerned with the rubber reclaiming process.**

THERE HAS BEEN only slight improvement in the process of making reclaimed rubber since Marks, working under Cowen's direction at the Boston Woven Hose and Rubber Company, developed the alkali process.

Much of the reclaimed rubber used today is made by the alkali process from discarded automobile tires. The devulcanizing, drying, refining, and straining equipment is approximately the same as it was twenty-five years ago. As a general thing it is much stronger and operates at a greater rate of speed.

The rubber reclaiming industry has not kept pace with the rubber industry as a whole. Ever since Charles Goodyear in 1839 accidentally heated a mixture of rubber, sulphur, and white lead and obtained vulcanized rubber, most of the development work has been accomplished by the "cut and try" method. The result has been that the exact chemical structure of the finished product has not been known. This lack of knowledge has been a tremendous handicap to the reclaimer. Since the original chemical structure of vulcanized rubber is unknown, it is much more difficult to determine what structural changes take place when it is treated with caustic, steam, oils, and heat.

As a compounding ingredient, reclaimed rubber plays a very important part in the rubber industry. It can be used either alone or in combination with new rubber. It is used as a shock absorber to reduce the violent fluctuations in the price of crude rubber.

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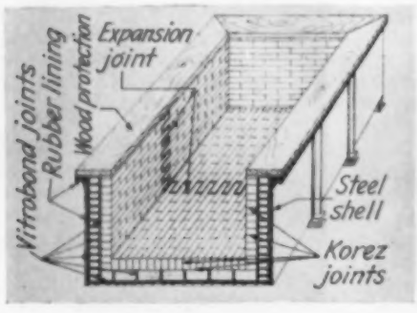
consist of a sheet of either solid Inconel or solid Monel bonded by hot-rolling to a base plate of ordinary steel; both sides can be coated if desired. These materials are available in plate thicknesses of $\frac{3}{16}$ in. and heavier. Inconel-clad steel, according to the manufacturer, has been used widely for chemicals, pharmaceuticals, food products, fatty acids, soap, oils and wool dyeing. Monel-clad steel is stated to have been used largely in salt-handling equipment and to be satisfactory for many acids, alkalis and salts.

### Non-Metals

Among the new developments to be shown by the American Hard Rubber Co., New York, is a hard rubber top for the Vorce electrolytic caustic soda cell. A special heat-resisting hard rubber compound is used to withstand the salt brine spray, chlorine gas and water vapor at a temperature of about 80 deg. C. Another new development is a hard rubber vinegar dumper for 6-ft. diameter vinegar generators.

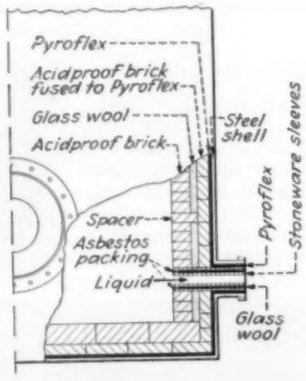



Dual Construction is the name of a new method of building tanks, towers, and similar chemical equipment which will be shown by the Atlas Mineral Products Co. of Pennsylvania, Mertztown, Pa. This is a method of brick lining for corrosion protection at temperatures to 250 deg. F. One variation of such construction employs a combination brick lining, in which a chemically setting synthetic resin cement known as Korez is used in the brick course next to the corrosive bath, while this company's plastic sulphur cement, Tegul-Vitrobond, is melted and poured into the joints of the back course of brick. This construction is said to be inert to both hot acids and mild alkaline solutions and to be unaffected by local overheating. Resistance to water and oils is also claimed.

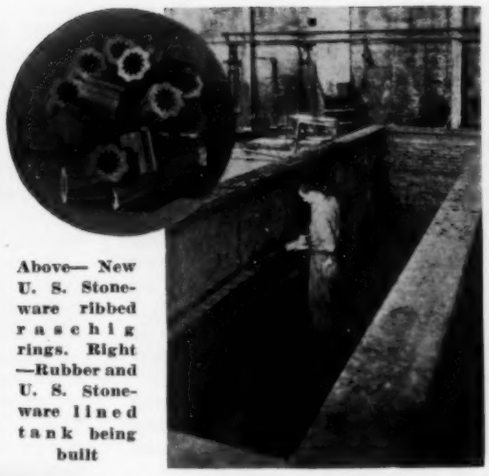
The essential function of the exhibit of the Bakelite Corp., New York, will be to show the new developments in plastics since the last Chemical Show. Among the developments shown will be special resins for bonding mineral- and glass-wool insulation, new types of synthetic resins for brake linings, oil-soluble styrene resins for air drying paints, extruded thermoplastic cable coatings, improved varnished cambrics, and polystyrene film for wound capacitors. High speed automatic injection molding will be demonstrated.

Carborundum Co., Perth Amboy, N. J., will show a complete line of heavy-duty super-refractories for chemical plant work including the new Monofrax brick and block, a recent development in a fused cast refractory which is said to be extremely resistant to corrosion at high temperatures. Another new development, Alfrax BI, an insulating brick for operation at temperatures up to 3,350 deg. F., will be shown. A new development to be exhibited by the Globar Division of this company is an air-cooled-terminal type of Globar element for use in electric furnaces.

One of the most recent developments to be displayed by the Dicalite Co., New York, is Dicalite 14, a finely divided calcined diatomaceous earth weighing about 20 lb. per cu.ft. Dicalite 14-B is similar but somewhat coarser, weighing about 16 lb. per cu-ft. Dicalite 14-W is the finest of these products. All three are employed as fillers in plastics in which they are




**At left and below is shown the new Atlas Mineral Products Dual Construction method for tanks. At right is a Knight insulated steel tank for operation at 1,000 deg. F. Corner—Lapp chemical porcelain ware**



**Above— New U. S. Stoneware ribbed raschig rings. Right —Rubber and U. S. Stoneware lined tank being built**

**Top and center are shapes of Karbate, National Carbon's new graphite material. Bottom—Farwell fabricated stainless steel pipe and fittings**

claimed to increase durability and flexibility and to give good electrical properties.

Its recently developed line of synthetic resin baking finishes will be the feature of the exhibit of the Heresite & Chemical Co., Manitowoc, Wis. These finishes are based upon synthetic resin materials, particularly those of the phenol-formaldehyde type. They are applied in the conventional manner and parts so treated are said to be resistant to a wide variety of highly corrosive conditions. Among the newer finishes are types suitable for both air drying and baking.

Previously, Maurice A. Knight, Akron, Ohio, developed acid-proof tank linings of Pyroflex-lined steel or Pyroflex-and-stoneware-lined steel or concrete. A new development to be exhibited this year is the use of carbon brick linings in place of stoneware. With such linings and suitable joint cements, hydrofluoric acid and caustic solutions can be handled. Still another new development in linings has been brought out to obviate damage due to the cracking of cement joints in large brick-lined tank walls from mechanical or heat conditions. Using Pyroflex protected steel, the stoneware tile, brick or carbon brick is fused directly to the Pyroflex. Joints are cemented as before, but no grouting is necessary. Each tile is cushioned and bonded to the Pyroflex which in turn is bonded to the steel or concrete retaining shell. According to the manufacturer the cement joints may fail entirely without harm to the vessel. Still another lining construction feature for towers handling gases up to a 1,000 deg. F., is to use a Pyroflex-stoneware lined steel vessel with an inner ceramic shell which is insulated thermally from the outside acidproof protection by an air- or glass-wool space. Even the gas or liquid connections may be similarly insulated.

A newly developed material known as Kemweld will be featured by the Kewaunee Mfg. Co., Kewaunee, Wis., and Adrian, Mich., for use in laboratory table tops. It is claimed that this material will withstand considerable abuse and the spillage of chemicals will not necessitate refinishing.

Examples of its extensive newly developed line of porcelain chemicalware will be shown by the Lapp Insulator Co., LeRoy, N. Y. This ware is now available in many forms, including pipe in sizes from 1 to 8 in. i.d., pots, kettles and process vessels up to 100 gal. capacity, valves from 1 to 4 in. i.d., funnels, vacuum filters, raschig rings and numerous special designs. The ware is unaffected by all acids except hydrofluoric, and is resistant to alkalis. The body is dense, homogeneous, completely vitrified and on dye absorption tests shows a complete absence of porosity. Excellent physical characteristics include a compressive strength of 100,000 lb. per sq.in. and a tensile strength of 5,000–8,000 lb. per sq.in.

Karbate is the name of a new carbon or graphite construction material, used where an impervious corrosion-resisting medium is necessary. This will be exhibited in the form of pipes and fittings as well as tile, brick and other shapes, by the National Carbon Co., Cleveland, Ohio. The use of this material in tank construction and heat exchangers will be shown. Karbate is extremely versatile and can be used with either screwed or flanged connections. Its impervious character is attained by forming a synthetic resin in the pores which are normally present in graphite and carbon. The material is about twice as strong as when untreated and has a thermal conductivity comparing favorably with most metallic construction materials.

At the last Chemical Exposition, the Norton Co., Worcester, Mass., featured porous mediums for electrochemical work. Many improvements in such mediums have been developed during the inter-

## THEN AND NOW IN PLANT OPERATION

**ERNEST F. THOENGES, plant manager for Hercules Powder Co., at Parlin, N. J., entered the industry as a chemist, but in 1915 was transferred to acid plant operations and since then has been intimately concerned with progress in this field, particularly in the manufacture and concentration of nitric and sulphuric acids.**

LARGE-SCALE PRODUCTION of nitric acid has undergone about as great a change during the past 25 years as could be conceived for any single chemical compound. Raw materials and construction materials have changed entirely. Objectionable byproducts are no longer produced and the process is now operated continuously.

Formerly nitric acid was made by distillation from Chile niter and 92 per cent sulphuric acid in a direct-fired cast-iron retort. The process was, of course, a batch one, producing about three tons of nitric acid in an eight-hour cycle.

Present large-scale processes for the manufacture of nitric acid involve the oxidation of anhydrous liquid ammonia by means of a platinum catalyst. The ammonia is shipped and stored in 25-ton steel tanks under pressure of about 150 lb. per sq.in. It is volatilized, mixed with preheated compressed air to form a 10 per cent ammonia mixture and this mixture is passed to a converter equipped with platinum gauze catalyst. Each converter, approximately 2 ft. in diameter and 2 ft. high is capable of producing over 40 tons of nitric acid per day. The ammonia is burned to NO and $NO_2$ and the mixture is oxidized with additional air and absorbed in bubble cap columns. One column about 6 ft. in diameter and 30 ft. high, when properly cooled, can absorb the entire output of one converter. The entire gas cooling and absorbing equipment is made of chrome steel. Operators and maintenance men per unit of product are less than a third of the number required 25 years ago. Meanwhile safety, cleanliness and good housekeeping have been vastly improved.

vening 24 months and these improvements will be a feature of this company's booth at the current exposition.

New developments in stoneware, synthetic tank lining materials, etc., will be shown by the United States Stoneware Co., Akron, Ohio. There are four new tank lining materials. Tygon, a synthetic rubber-like material of the modified halide polymer type, is claimed to be unaffected by practically all acids and bases, hydrocarbons and food products. Resilon, another resin-base material, is stated to be inexpensive and resistant to most mineral acids and bases. Rubber-X, a lining of the latex type, is suitable wherever a natural rubber lining is indicated, and is said to be available at lower cost than sheet rubber linings. Vintal, a synthetic resin coating resistant to alkalis and to acids except those of an oxidizing nature, is recommended by the maker for cosmetics, pharmaceuticals and food applications. The company will show several entirely new acidproof cements for stoneware construction.

A new line of splined or ribbed raschig rings which have approximately 25 per cent more absorption area than plain rings is now available for the first time in both stoneware and white porcelain. An entirely new heat-resistant stoneware body known as Ceratherm will also be exhibited. Having approximately the same porosity as standard-body chemicalware, the new material is stated nevertheless to withstand rapid thermal shocks at high temperature. Still another new development introduces a new principle in jar mill construction. One or more jars are set on rubber-covered rollers driven by a motor. This construction is available in both small-scale and production equipment.

Zapon Industrial Finishes Div. of Atlas Powder Co., Wilmington, Del., will show a new hot lacquer finish for wood known as H. T. A. Zaponite. This material is applied at a temperature just under 200 deg., with a spray gun, and is claimed to do the work formerly requiring three coats. A sealer is not required and only about half as much material is used, according to the manufacturer.

## MATERIALS HANDLING, FEEDING AND SAFETY

NEW DEVELOPMENTS in spiral woven wire conveyor belts, in actual operation, will be exhibited by Korb-Pettit Wire Fabrics & Iron Works, Inc., Philadelphia, Pa., together with other wire products including wire mesh for sizing, sieving, separating, straining, filtering and conveying.

Among the several new materials handling developments in the booth of Lewis-Shepard Sales Corp. Watertown, Mass., will be the new CB and PB stacker made in capacities up to 5,000 lb. with motors ranging from ½ to 5 hp. This stacker is of the folding type for passing under obstructions and may be equipped with a new design of spring balanced cylinders to enable one man to lower and raise the upper portion of the stacker safely and easily. The Jackmaster semi-live skid and handling wheel will be demonstrated. In this device, the skid has feet at one end, wheels at the other. Another new development is a lift truck of capacity up to 5,000 lb. equipped with an integral scale for combining transport with weighing. A new safety type carboy pourer for handling the newest type aluminum carboy will also be shown.

Several new or improved pieces of materials handling equipment will be exhibited by Stephens-Adamson Mfg. Co., Aurora, Ill. One of these is the new Tellevel automatic storage control, a simple switching device, used to start or stop conveyors feeding solid materials to bins. This is a dust-tight element containing mercury switches which, when solids rise to the level of its float-like bottom, tips and breaks the circuit. This company will also show a new two-piece Redler conveying element which has been added to the Redler line to supplement the conveyor-elevators with one-piece conveying elements. It will be recalled that the Redler is a conveyor in which moving elements within a closed pipe or trough cause undisturbed mass movement of pulverized solids.

A considerable variety of new vibrating equipment will be found in the booth of the Syntron Co., Homer City, Pa. Included in the list will be a wide-trough inspection feeder which is intended for spreading small objects such as small molded pieces over a wide area for ready inspection. Another new machine is a cabinet type dry chemical feeder, inclosed for attractive appearance. This device employs this company's electric vibrating feeder to control the flow rate. A new electrically operated continuous weigh feeder to be exhibited is intended to produce an accurately controlled steady flow of dry materials such as chemicals or coal. This machine comprises a combination of vibratory feeder, conveyor and a constant-speed belt conveyor suspended from a scale which operates sensitive electric valves to control the discharge of the vibratory device. Other new vibratory feeders include the Model FM-O-10 and the Model F-O. The former employs a hopper equipped with a vibrator for free-flowing and a vibratory feeder conveyor. This is a small capacity machine with a hopper size of 1 cu. ft. The latter omits the hopper, consisting only of a small vibratory feeder with a capacity up to 2,000 lb. per hour on 100 lb. of material. Both are complete with the necessary electrical controls.

### Safety and Fire Protection

Several new developments in fire-fighting equipment will be found in the booth of the C-O-Two Fire Equipment Co., Newark, N. J. One is a combination stationary-portable fire-fighting unit which may either be clamped to the wall as a fixed system, or removed and carried as a portable unit. A chrome molybdenum steel cylinder, a length of high-pressure

## THEN AND NOW IN PLANT OPERATION

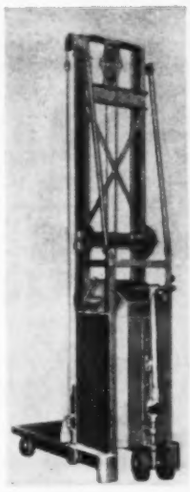
**EDWARD N. TRUMP of Syracuse, N. Y., is dean of the American alkali industry. In his sixtieth year of active participation in industrial work, he now looks back to a variety of important changes that have been effected in chemical engineering equipment since the beginning of the World War.**

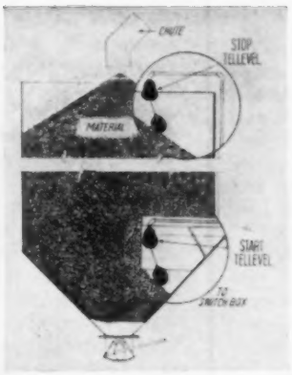
WHEN THE FIRST Chemical Exposition was held in 1915, many inventions and improvements in machinery and processes had been made, but were known to only a limited number of companies. Then came the wider distribution of technically trained personnel, who helped to bring these developments into use in other plants and for other purposes.

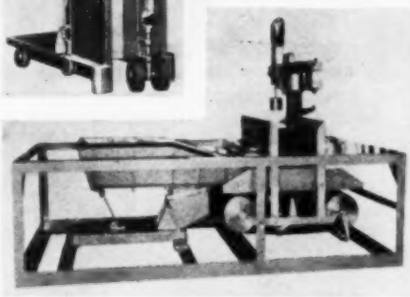
During the World War, attention was concentrated on the manufacture of chemicals like T. N. T., picric acid and other explosives, and to rapid increases in plant capacities. New machinery was built based on inventions which had been worked out during the preceding thirty years. Let me cite several examples:

A system of drying by suspending crystals in an upward current of heated air was invented. The air lifted and transferred its heat to evaporate the moisture. Improvements were made by increasing temperature, doubling the capacity and halving the power per ton dried. The apparatus was reduced to a simple cone, with a table feed, and an exhaust fan as the only moving parts. A heater and cyclone separator were provided after the bin to take care of the dust.

The failure of many continuous centrifugals which were tried out in the alkali industry to filter bicarbonate because of the glazing of the surface if scraped, led to experimental work on a type which moves the material continuously by centrifugal force without rubbing the surface being dried. These are now being developed.







**Top, left to right: Lewis-Shepard Type CB stacker; Stephens-Adamson Tellevel bin level control; Mine Safety oxygen measuring apparatus. Left—Syntron constant weight feeder**

reinforced flexible rubber hose, and a large discharge horn, fitted with a quick-opening valve, are used. Carbon dioxide is the extinguishing medium. This company will also feature an improved baffle-type nozzle which is compact and does not require a protruding horn to produce non-turbulent distribution of the gas.

One new item of the exhibit of Farwell Metal Fabricating Div., Farwell, Ozmun, Kirk & Co., St. Paul, Minn., will be its line of Fuller prefabricated metal safety scaffolding for plant maintenance work. This equipment is suggested particularly for doing overhead work on pipe lines and for placing machinery in position. Each scaffold leg consists of three adjustable legs each of which can be located at a different level to maintain a perfect three-point bearing.

A new development in carbon dioxide fire-fighting equipment, the new Kidde-Lux Model 2 fire extinguisher, will be shown by Walter Kidde Co., New York. This is a small, handy carbon dioxide extinguisher for use on incipient industrial fires, equipped with a pistol grip handle, valve trigger and discharge horn so as to permit discharging the contents of 2 lb. of carbon dioxide either steadily or in intermittent clouds. It is stated, therefore, to be particularly well suited to scattered or running fires.

Many new developments will be exhibited by Mine Safety Appliances Co., Pittsburgh, Pa. Of particular importance is a new all-vision-facepiece gas mask, carrying Bureau of Mines approval, which is stated to give increased comfort, greater safety, and exceptionally wide vision without visual distortion or undue side reflection. Fogging is said to be prevented without the use of anti-fog preparations. Light weight is a particular feature. A new oxygen recorder for measuring oxygen in process gases, excess air in products of combustion and air in gas transmission systems is said to be the first successful American solution to the oxygen recording problem. What is described as a new principle of measurement is employed. The recorder is essentially a voltaic cell of cast hard rubber containing an electrolytic solution which is strongly reducing. Two pure copper electrodes are provided. One is completely immersed, the second, in the form of a ring, revolves with part of its periphery submerged in the electrolyte and part exposed to the gas flowing through above the solution. The exposed portion of the revolving copper electrode reacts with the oxygen present to form copper oxide and this oxide, with continued rotation of the electrode, sets up a measurable potential against the copper electrode which is proportional to the amount of oxygen, but not the rate of flow of the sample. Other new developments include a benzol detector for reading benzol concentrations down to 20 p.p.m., a new gas mask intended particularly for chlorine protection, an improved hand operated blower for hose masks, a new respirator for Type A dusts, a new electrostatic dust and fume sampler employing the principle of pre-ionization and electrostatic precipitation, a quick-acting fire blanket for personnel protection, Foille, a new burn treatment available in tubes or bottles, and a new HCN gas detector.

Four styles of industrial gloves made from neoprene under the name of Stanzoil, which are available in a complete range of sizes, will be exhibited by the Pioneer Rubber Co., Willard, Ohio. These gloves are oil, grease, naphtha and gasoline proof and are constructed of a layer of neoprene bonded to an inner lining of especially processed rubber. This construction is said to insure against rubbing and chaffing and to make the gloves more flexible.

Pyrene Mfg. Co., Newark, N. J., will exhibit at the Exposition its latest de-

**Top left—Kidde Lux 2-lb. carbon dioxide extinguisher Top right—C-O-Two portable-stationary fire equipment Center left—Mine Safety all-vision-facepiece mask. Left—Pyrene Phomaire playpipe and portable container Above—Pprene portable Phomaire equipment in action**

**JOHN H. BAKER, superintendent, Pennsylvania Salt Manufacturing Co., of Washington, had long experience in the alkali industry before he helped to build and operate his company's West Coast plant at Tacoma. His short summary of operating contrasts is confined to electrochemical equipment for caustic soda and chlorine production.**

WHEN VIEWED IN THE LIGHT of present-day practices, the writer's 25 years or more of experience in the electrochemical operations involved in the production of chlorine and caustic soda, discloses a surprising number of changes that have resulted in progress for the industry. Competitive conditions, both from the standpoint of marketing and production, have contributed materially to increased efficiency. The quality of the finished product of today is radically different from that at the time of the first Chemical Exposition.

Confidence in the future of chemical industry has made the necessary capital available for research and development. Our schools and universities have developed their curricula so that the graduates have been coming to the industry better equipped for their chosen profession.

Equipment manufacturers through their research and experimentation, have helped us to build and operate much more modern and efficient plants and processes than those of a quarter of a century ago.

## THEN AND NOW IN PLANT OPERATION

velopment in foam-making water nozzles, the PP24 Phomaire play pipe. This device consists of a special nozzle and a Phomade tank which is carried on the operator's shoulders. The device is said to produce 350 gal. of foam from only 1 gal. of Phomade solution. The Phomaire play pipe is connected to an ordinary hose line and the water turned on. Phomade and air are then drawn into the water stream to form foam. Only one person is required to handle the play pipe. Operation may be continued indefinitely by merely pouring additional solution into the container carried on the operator's back.

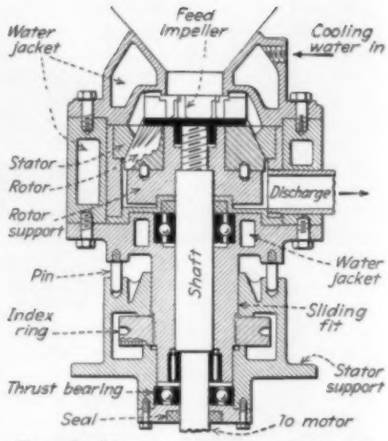
### MIXERS, BLENDERS AND COLLOID MILLS

AN IMPROVED line of portable motor-stirrers for processing tanks and other vessels will be shown by American Instrument Co., Silver Springs, Md.

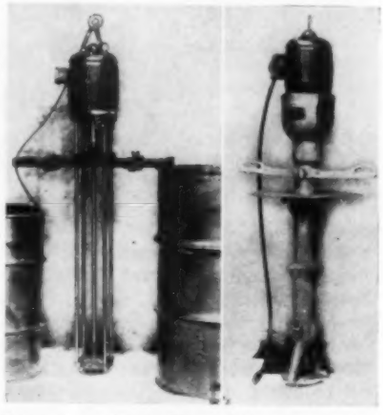
Two new developments to be shown by H. L. Bullock, New York, are novel types of mixer developed by the Lawrence Pump & Engine Co., Lawrence, Mass. The Type MR Vortex Shear mixer is designed to pull material into the center of a dispersing head and deliver it in the form of high velocity horizontal jets which serve to dislodge any heavy material on the bottom of the tank, and low velocity vertical jets which produce uniform circulation of the mix. The circulation produced by this unit is such that a slight vortex is formed, which may make the Type MC mixer preferable. The latter, known as the Vortex Fountain mixer, draws material in at the top and bottom of the dispersing head and delivers a portion of the material as high velocity horizontal jets, while another portion is delivered up through a center column and out into the mix through a series of holes in this column. Thus circulation is produced from the center of the tank outward at the top, avoiding formation of a vortex.

A new sanitary model of colloid mill for use in food and pharmaceutical applications will be exhibited by Chemicolloid Laboratories, New York. The new model follows the principles of this company's other colloid mills, but is designed for easy dismantling and cleaning. Stainless steel construction is featured. A capacity of 500 g.p.m. on a mixture comparable to ice cream mix is claimed for this unit.

New equipment to be shown by Eppenbach, Inc., Long Island City, N. Y., will include the Homo-Mixer and a new design of vertical colloid mill for use in paint and color processing. The mixer is a high-speed type for mixing and emulsifying without the incorporation of air. It picks up material from the bottom of the tank and discharges it upward, applying power to only a small percentage of the material at a time. This mixer is made in any desired metal in sizes ranging from laboratory size to models big enough for tanks of several thousand gallons. Full adjustability, freedom from vibration, and portability, are important features. The new vertical colloid mill, shown in the accompanying cross section is intended particularly for pigment grinding and color dispersion in liquids. The mill is water cooled and features ready cleanability and interchangeable parts.




**Eppenbach's new vertical colloid mill**



**Lawrence Type MR and MC Vortex mixers**

Two recent developments will be exhibited by the Manton-Gaulin Mfg. Co., Everett, Mass. One of these is a two-stage colloid mill which is of stainless steel construction and features direct connection to the motor gear case for compactness. The material to be treated is introduced and impelled through the first stage gap by impellers located on the front rotor face. In this gap the material receives a primary treatment, after which the impelling action of the rotor forces the material across the top edge of the rotor and down into the second stage where it receives a secondary finishing treatment. A new laboratory homogenizer, also of stainless steel construction, is available with single- or two-stage valve assembly. It employs a reciprocating plunger type pump to force the product between the valve seat and valve. Pressure is applied to the valve by means of a handwheel so as to adjust the valve gap.

In addition to an all-color motion picture which will demonstrate the mixing action of its equipment by a new method, picturing the motion by means of colored tracer balls, the Mixing Equipment Co., Rochester, N. Y., will show various models of portable and side-entering mixers. Two of these are designated as Type 2 and Type 3. Type 2 employs a welded steel

reinforced support, a geared motor and a propeller shaft carried on a special bearing and packing member. Splash-proof, totally inclosed, or explosion-proof motors are available. Type 3 is a V-belt driven model consisting of a propeller, shaft, bearing member, Texrope drive, welded steel support bracket of cylindrical shape and an extra anti-friction radial and thrust bearing at the rear.

New England Tank & Tower Co., Everett, Mass., will give a smaller scale demonstration of a type of mixing research which has been in progress at the company's plant in recent months, and will exhibit many data and graphs obtained from these results. In this demonstration, a 275-gal. rectangular steel tank with corners filleted to a 10-in. radius will be used. It is equipped with a special agitator drive, an 18-in. turbine and a direct-connected four-speed 3-hp. motor.

A totally new development of this company is the Nett-co continuous mixer, a device for agitating, mixing and blending two or more fluids continuously, while in transit through a pipe line. Rather than introducing a pressure drop, the unit actually increases slightly the pressure in the line and is said to be self-cleaning and non-clogging. The liquids to be mixed are fed into a single main, then enter the continuous mixer where they come in contact with a high-speed turbine agitator. The flow is forced to divide into a number of individual streams and then enters a second mixing chamber containing an additional impeller agitator which mixes the liquids further and divides the stream into two streams which then re-unite.

### Kneaders and Blenders

Two new mixers will be shown by Baker Perkins Co., Saginaw, Mich. One is the Type BB Universal mixing and kneading machine which has been markedly improved in several respects. A new self-contained hydraulic tilt equipped with a double-acting hydraulic cylinder is used. Oil under pressure from a motor-driven pump mounted on the same base controls tilting and return. Roller bearings are provided throughout. By an ingenious use of helical gears, equal torque at both ends of each blade is stated to be attained. The gear guards are shown removed in the illustration to show this feature. Another new feature is the redesigned jacketed trough suitable for high temperature operation with such heating media as oil or Dowtherm. Working capacities range from 20 to 600 gal. Another new Universal mixer is designed for operation under high vacuum. Hydraulic tilt is provided, together with a hydraulic cover-lifting mechanism. A single control first lifts the vacuum cover and then tilts the trough to discharge position. This machine has been further improved with a single stuffing box design. The only packing against the atmosphere is where the drive shaft enters the gear guard, the latter being vacuum tight. The agitator stuffing boxes, therefore, operate under equalized pressure.

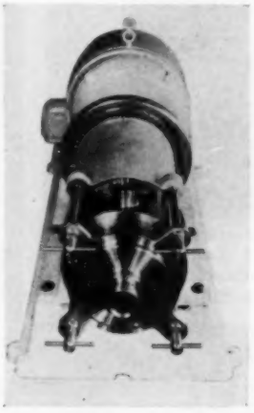
A new conical blender for granulated materials will be exhibited by Blaw-Knox Co., Pittsburgh, Pa. The feature of this type of blender is the development of a tossing action for the charge instead of a strictly rolling movement. This is said to prevent segregation. Stainless steel construction is employed in the unit illustrated which is 64 in. in diameter and designed to handle up to 2,000 lb. of granular material per charge. An integral motor and reducer are employed. To permit stopping the drum accurately at any position a solenoid-operated brake and a start-stop-inching control are provided.

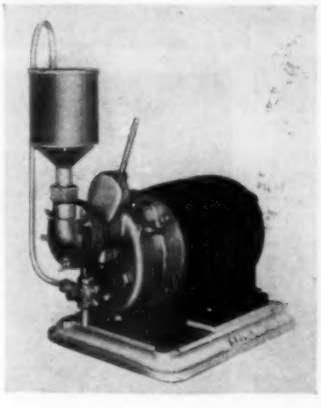
Several new pieces of equipment will be on display in the booth of the Read Machinery Co., York, Pa. One of these is a new single-packing-gland, double-arm vacuum mixer which will be shown in the 15-gal. size although it is built in total capacities up to 600 gal. The striking feature of this design is that the only point where it is necessary to seal a rotating shaft against the atmosphere is where the front arm shaft projects through the gearcase. At this point a deep stuffing box and lubricating lantern gland are used. Quickly removable shaft seals are employed between the mixing chamber and the vacuum chambers on each arm shaft and the seals have equalized pressure on both sides. Other features include close clearance of the mixing agitators, a jacketed bowl and cored arms for heating and cooling if desired, and an especially heavy mixing bowl. Double-arm mixers for laboratory use, also to be shown, are made in sizes from 1 to 3 qt. working capacity. Easy dismantling and cleaning are particular features of the design.

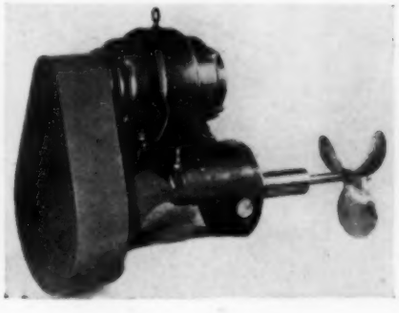
This company plans to show a complete materials handling system including a new type of vibrating sifter feeding a blender with the material returning by

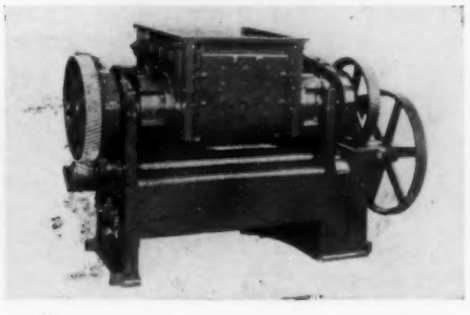
**Top row, left to right: Charlotte sanitary colloid mill made by Chemicolloid; New England Tank & Tower continuous mixer; Blaw-Knox blender for dry materials**

**Bottom row, left to right: Gaulin two-stage colloid mill; Mixing Equipment Co.'s new belt driven side-entering agitator; Baker Perkins 50-gal. jacketed Universal mixer and kneader**









elevators, conveyors and other equipment. Another new mixer to be shown is the Type D4-80, a vertical mixer employing a double-whirling beater motion or planetary mixing action. This machine has four positive speeds, obtained through an automotive type sliding gear transmission. Vibration is said to be eliminated. The model shown will be steam-jacketed.

## PACKAGING EQUIPMENT AND SHIPPING CONTAINERS

THE RECENTLY developed Acme No. 2 strapper is to be exhibited by Acme Steel Co., Chicago, Ill. This device, intended for quickly applying ⅝ and ¾ in. steel strappings to heavy shipments is said to be the only strapping tool for this size work which combines the tensioning, sealing and cutting operations with an automatic seal feed. A single stroke of each of the two operating levers does the complete strapping job. One lever tensions the strap, while the other seals the joint and cuts the straps from the coil without waste.

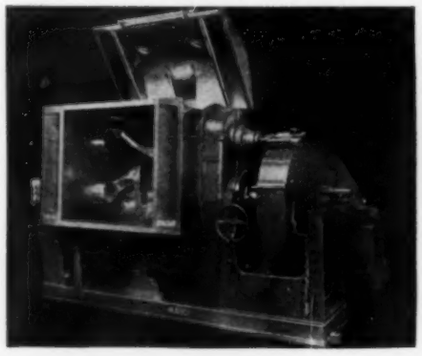
Equipment shown in the booth of the Horix Mfg. Co., Pittsburgh, Pa., will include two new types of bottle and can filling equipment, one a high speed fully automatic rotary filling machine and the other a small portable vacuum machine. In its largest size the rotary type will fill alcoholic beverages at a speed of 150 quart bottles per minute. This machine is of the gravity-vacuum type so designed that if anything goes wrong the machine will stop until the condition is corrected. The small portable machine is equipped with a motor-driven unit stated to be unusually compact and light in weight. An automatic oiler and safety trap to prevent the liquid being filled from being carried into the vacuum pump are provided.

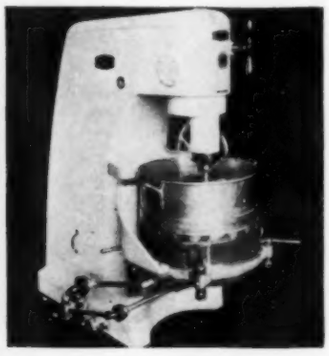
Carl Kiefer Machine Co., Cincinnati, Ohio, will demonstrate a number of new sorts of filling machinery. Among these is the Endweld tube filler and sealer for filling pasty materials into collapsible tubes. The tubes are cleaned with filtered, compressed air and any dust and carton fibers mechanically collected. Filling is then accomplished by a vacuum-operated principle which prevents formation of air bubbles and is said to assure precise measuring. The tube bottoms are then shaved to identical lengths and finally welded. It is claimed that the saving in tube metal will pay for the equipment in less than a year. Another new device, an automatic rotary vacuum filling machine for handling up to 300 bottles a minute, is made in eight sizes in all of which the power plant is housed in the base. Variable-speed drive and safety devices are features of the design. A third development, the "Bottoms Up" rotary bottle cleaner, automatically removes bottles from the conveyor, turns them up, blasts them with filtered compressed air and returns the bottles upright to the conveyor.

Perfektum Products Co., New York, plans to exhibit two new pieces of ampoule filling and sealing equipment. The Ampfil is designed for the automatic filling of ampoules at a steady speed of 1,000 discharges per hour, delivering accurate dosages with each discharge; 10 cc. and 50 cc. sizes are available. The Ampseal is used for sealing glass ampoules at the same rate and is novel in that it produces the same type of seal as obtained by hand by pulling and twisting as it seals.

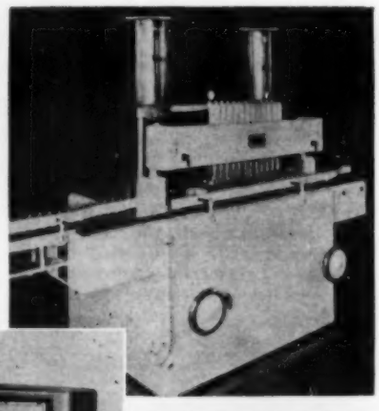
A line of fillers known as the Pfaudler-

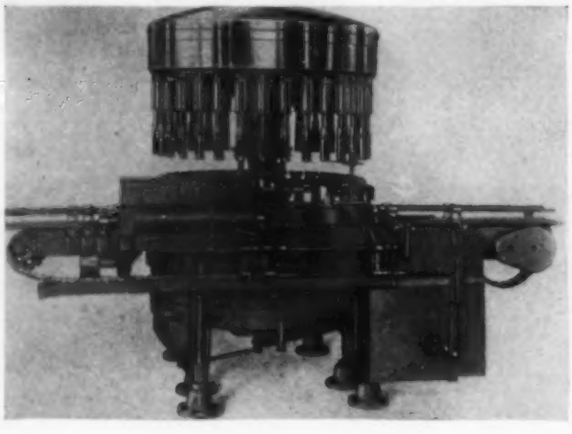
**Two new Read Machinery Co. mixers, the single packing gland vacuum type at the left, and the D4-80 vertical type**



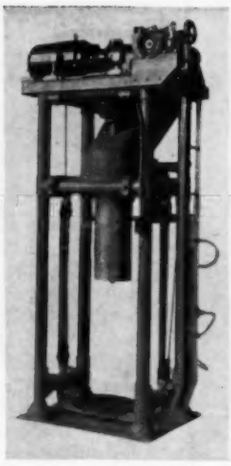


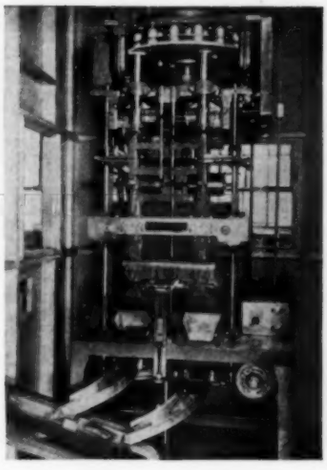
**Left—Acme No. 2 strapper in action**
**Below—Pneumatic Scale bottle filler**

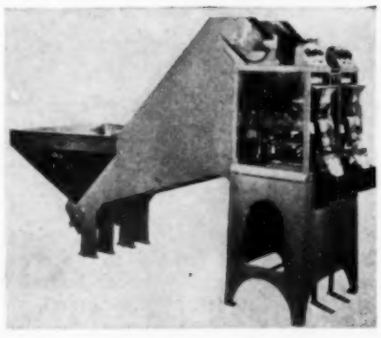




**Below, left to right: Horix automatic rotary filling machine; Kiefer Endweld tube filler and sealer; and Perfektum Ampfil, for automatic ampoule filling**







**Top row, left to right: St. Regis one-tube belt packer; Sprout-Waldron compression packer; Stokes & Smith Pliofilm bag filler; left: Triangle-Rapp weigher and packer**

King piston type is a new departure with the Pfaudler Co., Rochester, N. Y., which will be exhibited at the Exposition. This device is intended for viscous materials, such as paint, greases, salves, and so on. Special features of these fillers include a safety device to prevent filling in the event a can fails to arrive in the filling position; a positive cut-off valve to eliminate drip; easy adjustment and easy cleaning; variable speed drive on motor-operated models. Complete motor-operated models, hand-fed motor-operated models, and hand-operated piston fillers are all available.

A new automatic filler for bottles which operates at the rate of 60 to 70 pints per minute, will be the feature of the booth of the Pneumatic Scale Corp., Quincy, Mass. The machine proper requires a space only 3 ft. 9 in. by 7 ft. 2 in. and with continuous intake conveyor is only 15 ft. 6 in. long. Quick changeover from one size to another, quick draining, easy cleaning, a built-in safety control, and a new high-speed filling nozzle are important features claimed by the manufacturer of the design.

St. Regis Paper Co., New York, will exhibit a new model of packer for the filling of multi-wall paper bags of the valve type. In common with other packers built by this company, it is of the belt type in which solid material is carried around the periphery of a rapidly rotating grooved wheel, being held in the groove by a belt traveling at the same speed as the wheel. Thus the material is thrown at high velocity from the periphery of the wheel through a filling tube and into the bag. The new packer differs from other belt packers in that it has but one tube and is made smaller for ready portability. This packer simultaneously fills and weighs the bags, the weighing mechanism being an integral part of the machine. When the desired weight is reached, a cutoff valve at the top of the machine is automatically closed. With one operator this machine has a capacity of five 100-lb. bags per minute.

Among the new developments to be shown by Sprout, Waldron & Co., Muncy, Pa., is an all-electric automatic compression packer for filling containers ranging from 50-lb. bags to 400-lb. barrels with powdered materials or materials with sufficient flow to pass from the receiving hopper to the packing tube. Adjustable packing pressure, fully automatic control for lowering and lifting the package carriage and special electrical equipment are features. Material is spouted to the receiving hopper whence it flows by gravity to the packing tube. Once in the tube it is compressed up to 800 lb. pressure, if desired, and discharged into the container. The capacity is up to four bags per minute.

A modification of its standard machine for making and filling bags of such products as pharmaceuticals and foods will be demonstrated by Stokes & Smith Co., Philadelphia, Pa. Whereas the machine previously made packages only from Cellophane, the modified machine is designed to use Pliofilm. Certain changes have been necessary in the design owing to the fact that Pliofilm is softened all the way through when heated for the heat seal, whereas Cellophane is softened only on its surface.

The new Triangle-Rapp Elec-Tri-Pak weigher and packaging device will be the featured exhibit of the Triangle Package Machinery Co., Chicago, Ill. Synchronized-control feed belts deliver small amounts of such materials as granules, crystals, tablets, pills, etc., from the main supply hopper to a vibratory feeder. This feeder has two speeds for rapid feeding, with accuracy attained by dribbling as the correct weight is approached. For coarser materials, a second vibrator is provided to separate the pieces and control the feed so that weighing accuracy, in many cases, is claimed to be within one piece. A new type mercury switch is used which, according to the maker, is equal to and simpler than the customary electric eye for this service.

### Shipping Containers

Aluminum Co. of America, Pittsburgh, Pa., has developed and will exhibit two

## THEN AND NOW IN PLANT OPERATION

**GEORGE W. REPETTI, vice-president of the Holly Sugar Co., San Francisco, Calif., has long had an interest in sedimentation and clarifying operations, particularly as applied in the beet sugar industry.**

PROCESSING OF SUGAR BEETS for the direct production of granulated sugar involves from five to eight separate steps in filtration or clarification. Twenty-five years ago these operations were effected entirely in filters of the pressure type. The plate and frame units predominated, with some installations of Kelly and Sweetland units. All incurred heavy labor and material costs as compared with today's operations.

In the present modernized American factory, pressure units are still employed for the clarification of solutions carrying less than 0.5 per cent of suspended solids. Those carrying higher concentrations are generally handled in continuous thickeners and drum-type filters, usually in combination. The Dorr thickener is very widely used and, to a lesser degree, other types. The Dorr system of continuous carbonation has given great impetus to the continuous sedimentation and filtration of sugar juices. The factory of 1915 consumed some 50 to 75 sq.ft. of filter fabric per 100 tons of beets processed. The modernized factory today uses only from one to two square feet. That of 1915 used 20 to 30 man-hours while that of today employs but 5 to 10. Improved cake washing has markedly reduced losses of sugar and consumption of fuel for evaporation.

**MARLIN G. GEIGER, resident manager of Westvaco Chlorine Products Corporation at South Charleston, W. Va. began plant operation with Warner Chemical and has worked through a variety of supervisory jobs to his present position. Among other things, he has been a keen observer of progress in evaporation.**

## THEN AND NOW IN PLANT OPERATION

LOOKING BACKWARDS 25 years in the operation of evaporators, almost makes one want to turn about-face promptly to peer into the future. Equipment then was small and for the most part double-effect. Bodies were of ordinary cast iron; tubes were of charcoal iron or in some cases of copper where it could be used. Machines were of plain but rugged design so that they could withstand the hard treatment of inexperienced operators as well as the corrosive character of the liquors.

In removing salt in the evaporation of electrolytic caustic soda, many were the difficulties experienced. It was recovered mainly in baskets suspended below the evaporator and from which it was often necessary to shovel the salt. Today continuous systems eliminate the hazards of these early operations.

With increased technical knowledge of alloys, the size, shape, weight and number of bodies have changed. It is no longer a strange sight to see complicated quintuple-doubles or quadruple-doubles or even quadruple-triple effect systems in operation. They assume all manner of shapes in which heating elements, long the operator's nightmare, have important places. Tubes are short or long, single or in groups, in order to handle either pressure, forced circulation, vacuum or flash types of evaporation. Pumping and fluid transfer equipment has likewise improved with the art. All of this has placed evaporator rooms in the same category as the power plants as show-places of the industry.

Proper instrumentation has reduced interruptions of operations to such an extent that it is rarely necessary to provide the standby equipment which was once the rule. Continuous systems have reduced the number of operators to such an extent that you have to install an electric call system sometimes to find the man on the job.

new aluminum shipping containers, a 16-lb. aluminum carboy of 13 and 15 gal. size and a light-weight 55 gal. drum weighing only 40 lb. The carboy has a screw closure and is intended for the shipment of non-regulatory products. The aluminum drum corresponds in dimensions to steel drums of the same capacity and is equipped with either aluminum or stainless steel fittings of standard design. Smaller sizes down to 10 gal. are available. The material is a strong work-hardened aluminum alloy.

Rapid tightening of drum plugs is assured with a new air wrench which will be exhibited by the American Flange & Mfg. Co., New York. The wrench is fitted with combination jaws of non-sparking copper alloy which fits both a ¾ in. and a 2 in. "Tri-Sure" plug. Use of the wrench is said to assure uniformity and speed. An operator working on a conveyor line is stated to have closed 840 openings (420 drums) in one hour using this wrench.

Bemis Bro. Bag Co., St. Louis, Mo., expects to feature an improved line of waterproof bags. Generally these bags employ a three-ply construction consisting of an inner layer of flexible creped kraft paper impregnated with a layer of waterproof adhesive which also seals the pores in the outside layer of burlap or cotton, and cements both layers together. Various weights of fabric are available for the outside while the insides are also made from a variety of materials. Either conventional sewn side and bottom seams, or this company's special cemented center seams and taped bottoms (eliminating stitch holes), are available.

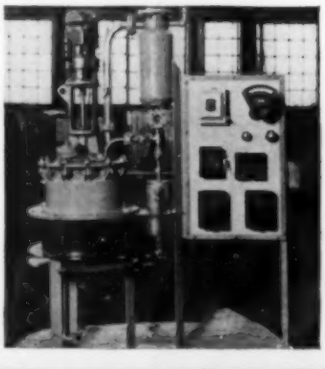
Cleveland Container Co., New York, will feature an improved line of drums for shipping fine chemicals, molding powders and similar materials. These drums are made of either chip or manila board with bottoms and covers die-pressed. Several diameters and any height that is practical are available. When used with pouch liners of either Cellophane, Pliofilm or treated papers, a heat-sealed closure is effected which supplies, according to the manufacturer, protection against moisture, vapor and grease.

Supplementing the I.C.C. 43-A 5- and 13-gal. all-rubber acid shipping drums previously announced. Maurice A. Knight, Akron, Ohio, will show a new 30-gal. capacity rubber drum of similar construction, weighing but 85 lb. empty. Like the earlier drums of this line, the new one is stated to be suitable for the handling of such acids as hydrochloric, hydrofluoric and dilute sulphuric. Because of its lightness in comparison with boxed glass carboys, the new drum is said to effect striking savings in freight costs. Now up for I.C.C. approval, the drum may be at present used for plant storage and local handling, as well as for the shipment of liquids not classed as dangerous.

Rubber siphon discharge devices are available for this drum.

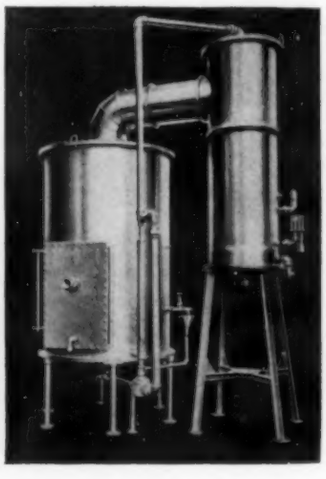
### PROCESS AND REACTION EQUIPMENT

**Blaw-Knox electrically heated kettle**
**American Flange air wrench for drums**

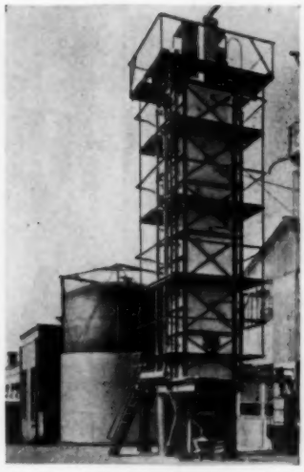


BARNSTEAD Still & Sterilizer Co., Forest Hills, Boston, Mass., will feature an improved line of automatic, continuous water stills with vertical condensers, available in capacities of 300 to 500 gal. of distilled water per hour. Two steam coils are used, each mounted on a removable man-hole cover for easy accessi-

**Barnstead automatic water still**



New 15-gal. aluminum carboy



Above—Fansteel tantalum condenser and Gillette carbon dioxide generator
Left—Special Koven jacketed still

bility and cleaning. The condenser ends are likewise removable for ready cleaning. Heavy brass and copper with interior surfaces heavily tinned are used in this construction.

Among a number of types of reaction equipment and equipment for other unit operations to be shown by the Blaw-Knox Co., Pittsburgh, Pa., will be several new developments. Deodorization equipment for vegetable oils, for example, will be exhibited. This equipment is of the high vacuum type in which the vacuum is produced by multi-stage steam-jet ejectors. Newly designed resin kettles, equipped for high temperature heating either by electricity or Dowthern vapor, will also be shown.

The principal feature of the exhibit of the Fansteel Metallurgical Corp., North Chicago, Ill., will be a plant-size hydrochloric acid absorption system for the production of 10 tons of 20 deg. Bé. acid per day from gas containing 60 per cent HCl, or 5 tons of 22.5 deg. Bé. acid from gas containing 70 per cent HCl. The complete unit requires less than 50 sq. ft. of floor space and less than 15 ft. of headroom. Like the original tantalum absorber, announced at the Chemical Show in 1937, the new absorber utilizes tantalum in the heat transfer surfaces and acid-proof materials in all parts which come in contact with HCl gas or the acid produced. Unlike the 1937 absorber, the new unit will produce strong acid without acid recirculation from gas containing as little as 30 per cent HCl and will absorb the acid completely from gas containing as little as 15 per cent HCl.

The Gillette carbon dioxide generator for the manufacture of pure concentrated carbon dioxide gas will be presented by the Gillette Kiln Sales Co., Neville Island, Pittsburgh, Pa. This new generator produces carbon dioxide gas as its principal product and a high grade lime as a secondary product. The exit gas is stated to analyze approximately 98 per cent $CO_2$ with 1.5 per cent of nitrogen and minor percentages of oxygen, carbon monoxide and sulphur dioxide. These results compare with a carbon dioxide content of 30-35 per cent which is stated to be usual with old-fashioned shaft lime kilns.

The new generator is essentially a vertical rectangular firebrick furnace, divided by a carborundum retort extending the entire height. A 2-in. layer of block insulation surrounds the entire structure. Six burners are employed, three in each retort, the type of burner used depending on the type of fuel employed. On the bottom of the retort is a patented water-cooled discharge mechanism which controls the rate of flow of the limestone and lime and provides means for preventing infiltration of outside air. Carbon dioxide gas is drawn off through two special castings to small water spray scrubbers which remove any lime dust and cool the gas to atmospheric temperature.

Various sizes of limestone down to particles as small as $\frac{3}{8}$x$\frac{3}{16}$ in. may be employed. The stone is elevated to a feed bin at the top, whence it moves by gravity downward at about 4-5 in. per minute through the retort. A recovery of 90 per cent of the carbon dioxide originally contained in the limestone is claimed for a purity of 98 per cent. For a 90 per cent purity, 95 per cent may be recovered. The standard size generator, which is roughly 30 ft. high and 6x12 ft. in outside cross section, has a capacity of 3 to

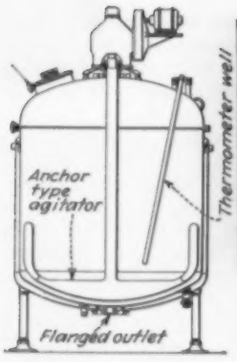
## THEN AND NOW IN PLANT OPERATION

**DR. GUSTAVE T. REICH of the Pennsylvania Sugar Company, of Philadelphia, has had a prominent part in the advance of distillation equipment, especially as it has been developed for the production of industrial alcohol and its chemical derivatives.**

PROGRESS MADE in the distillation operations of the alcohol industry can be summarized as follows: Improved quality, increased yield, and decreased manufacturing costs. To accomplish all of these, the first step in the right direction was the use of continuous instead of batch stills, thereby insuring a uniform quality of product. Almost all continuous stills are operated under pressure, although some manufacturers believe that an all-vacuum continuous distillation unit for spirits yields a purer grade of alcohol. The old-type dephlegmators and worm condensers have been replaced with shell and tube condensers. Distilling columns replace the dephlegmators more and more. Bubbling caps provided with vertical slots show less tendency to plug up and give a tangential direction to the ascending vapors and liquid. Bourbon stills are mostly continuous, permitting an exact regulation of the fusel oil and other compounds which are essential to a high quality product. Rye stills are preferably semi-continuous, while cologne spirits are made only in continuous stills.

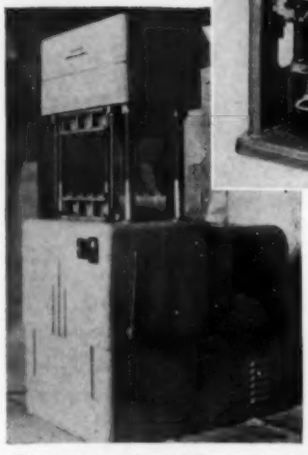
Increased thermal economies are accomplished by preheating the beer with slop or vapors. Individual pumps simultaneously supply beer and pump the slop out of the still. Instead of depending upon the operator, the stills are remotely controlled automatically and provided with temperature and pressure controllers, compensating automatically the steam and cooling water temperature; regulating the reflux ratio to the various columns, also the speed of beer and slop pumps, and in conjunction with the use of efficient heat exchangers the steam consumption has been reduced from 15 to 30 per cent. Flow of condensate is regulated by weir boxes or rotameters.

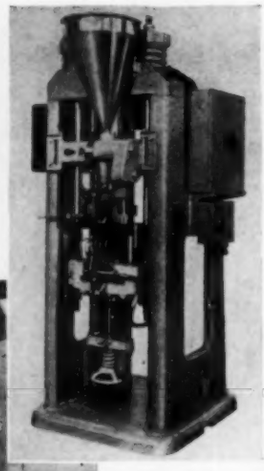
Further economies in distillation are indicated by operating the stills as multiple effect units, under high pressure or vacuum, or sometimes in conjunction with a slop recovery system, thereby decreasing manufacturing costs and investments.

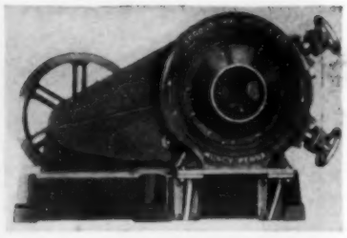


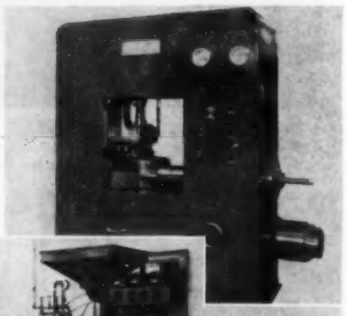

Outline of new Pfaudler kettle of 2,000 gal. capacity which is over 14 ft. high overall

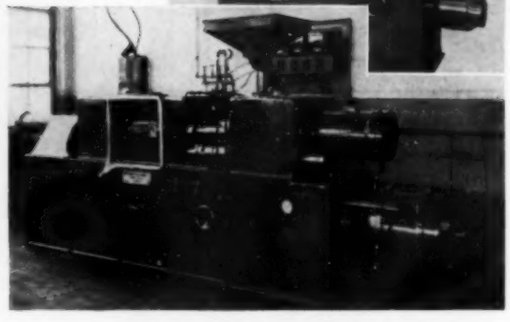
Lee Super-Jacketed stainless steel kettles in a plastics plant











Two automatic molding presses, the Stokes automatic and, below, the Standard semi-automatic machine

Top—Sprout-Waldron pellet mill. Above—Two Watson-Stillman automatic molding presses, the compression machine and, below, the injection press

4 tons of $CO_2$ and 4½–6 tons of lime per 24 hours.

Special process equipment of various types will be exhibited by L. O. Koven & Bro., Jersey City, N. J. Typical of equipment developed by this company is an all-aluminum jacketed still equipped with a specially designed agitating mechanism and a sight glass in the top. The still is partially jacketed with an aluminum shell for steam or hot-water heating. Interior pressures between 29 in. vacuum and 14 lb. gage may be employed. Another typical piece of process equipment is a steam-jacketed cooker made entirely of 18-8S stainless steel of ⅞ in. thickness. The jacket is built for 120 lb. of steam pressure and the interior working pressure is 29 in. vacuum.

Equipment developed originally for food industry use will be shown for the first time to the chemical industry by the Lee Metal Products Co., Philipsburg, Pa. This concern plans to exhibit from among its various types of corrosion resisting equipment its line of steam-jacketed kettles and tanks. These will be of several types made of stainless steel, nickel and Monel. One type is known as the Super-Jacketed kettle, which takes its name from the fact that in order to obtain larger heating surface and larger jacket capacity than is usual with round-bottom jacketed kettles, the outer jacket is larger in diameter than the kettle.

The Pfaudler Co., Rochester, N. Y., announces that one of the most important of its developments since the last Chemical Show has been the development of glass-lined reaction equipment in sizes up to 2,000 gal. (or even larger in some cases), whereas 1,000 gal. was formerly the limit. Furthermore, glass-lined equipment has been developed for much higher pressures and such equipment is now fabricated in accordance with the A.S.M.E. code for high pressure vessels. Reaction kettles of 2,000 gal. capacity may be supplied with or without a glass-coated propeller or impeller agitator. A new design of stuffing box for the agitator shaft is stated to have been an outstanding mechanical advance. This company has recently entered the manufacture of alloy steel process equipment, some of which will be exhibited in addition to the glass-lined equipment.

### Presses and Pellet Mills

A considerable number of newly developed products will be exhibited by the F. J. Stokes Machine Co., Philadelphia, Pa. Perhaps the most striking of these developments is the Stokes No. 200 completely automatic molding press. This is a modification and extension of the idea presented in this company's first automatic molding press at the last Chemical Exposition. This machine is a 15-ton capacity 10-in. stroke press for molding thermo-setting plastics. Objects having up to 19 sq. in. of projected area can be molded. Single-cavity molds are used, and the machine, operating continuously, is stated to equal the production rate of large multi-cavity molds used in conventional molding methods. Output from such a machine is stated to be up to 10,000 or more pieces per week and proportionately greater when two or more sub-cavities are used in the same machine. Another new molding press, the Standard Semi-Automatic, will be shown in a new stream-lined model. This press is of the toggle type for rapid operation, with self-contained hydraulic pump, piping and controls. Through the use of an automatic controller for completing one cycle, one operator frequently is able to run up to six presses.

Another new Stokes development is a modification of the Type T tablet machine developed especially for ceramic dry pressing and making chemical tablets of larger size, requiring less density than customary.

The new Pellet mill to be shown by Sprout, Waldron & Co., Muncy, Pa., is used to agglomerate permeable, free-flowing material into pellet or nodule form. Tapered rollers working within an annular die compress the material into and through the die hole and, as the material is extruded, it is cut off by two knives which can be adjusted to regulate the length of pellet. Available dies make pellets of $\frac{3}{32}$ to ⅝ in.

Two new machines for plastics molding will be featured by the Watson-Stillman Co., Roselle, N. J. One is a fully automatic compression molding machine which is a completely equipped, self-contained unit for both thermo-setting and thermo-plastic materials. Two hydraulic cylinders, one vertical and one horizontal, are used. An integral hydraulic power unit is provided and an automatic feed and ejector mechanism controlled by time cycle equipment. Sizes range from 25 to 400 tons capacity. The second new machine, an 8-ounce, fully automatic injection molding machine will accommodate dies up to 16x24 in., applying a maximum pressure on the material up to 50,000 lb. per sq.in.

# Chemical Engineer's BOOKSHELF

# Patents for the Chemical Engineer

## PATENT POLICIES

PATENTS AND THE PUBLIC INTEREST. By *H. C. Toulmin, Jr.* Published by Harper & Brothers, New York, N. Y. 205 pages. Price $2.50.

Reviewed by *R. S. McBride*

PATENT POLICIES have been subject to much criticism. The author of this volume undertakes to identify those criticisms that are justified and to answer those that are not. He takes a middle-of-the-road course, not undertaking to defend the system's faults but to explain why the system is itself good and how it may be made better in the public interest.

Very frequently chemical engineers are called upon to defend their own or their company's practices with reference to patents. For that purpose this volume will afford sound, clear reasoning and splendid persuasive examples of the value of the patent system. It can well be read for that reason alone.

Some of those who favor extreme patent practices, feeling that any monopoly so gained is fully justified, may not take too much comfort in some of the other features of this book. The public interest aspect of patents is, in other words, all through the volume as well as in the title. Mr. Toulmin has done a constructive, valuable job for the engineer and scientist as well as for the business executive. His book deserves cordial welcome. It may not help a man get a patent. In fact it does not attempt that. But it does clearly explain what patents are, why they are, and what they might well be to serve inventors and corporations, as well as public well being.

PATENT FUNDAMENTALS. By *Adelbert Schapp.* Published by The Industrial Press, New York, N. Y. 176 pages. Price $2.

ALTHOUGH THIS is a textbook it may very well prove of value to the industrialist or the patent attorney. Many a scientific worker is unfamiliar with the definition of true invention, procedure in obtaining patents, drafting claims, issuing licenses and in general how to protect himself and his patent. The problem of the chemist is taken up and several cases relating to chemical patents discussed. This type of information should enable the chemist or chemical engineer to cooperate more fully with his attorney when patent matters come up. On the other hand, scientific approach to patents is of value to the attorney. Of necessity comprehension of the subject matter makes him more competent. Thus, by giving the attorney some scientific concepts and the scientist certain legal aspects the amount of cooperation possible should definitely result in increased protection.

## STRATEGIC MINERALS

STRATEGIC MINERAL SUPPLIES. By *G. A. Roush.* Published by McGraw-Hill Book Co., Inc., New York, N. Y. 485 pages. Price $5.

MINERAL SUPPLY for process industry is a real problem at just this time. Thus this volume will be very welcome at any establishment or by any engineer who is concerned with the use of strategic minerals during present disturbed world conditions. The author is a man outstanding among the country's authorities on this subject. He has not only the background of long experience as editor of the annual series of volumes "The Mineral Industry," but also recent active participation in studies for the War and Navy Departments.

The volume gives a comprehensive, but easily used, presentation of important facts and trends with reference to the minerals: manganese, nickel, chromium, tungsten, tin, aluminum, antimony, mercury, platinum, mica, iodine, and nitrogen. There is substantial interpretation and some opinion. But the reader will have no difficulty in distinguishing between statements of fact and statements of author's opinion. Furthermore, Roush has taken a middle-of-the-road course in his presentation which will make the book most acceptable even to highly partisan readers.

A HISTORY OF CHEMISTRY. Third Edition. By *F. J. Moore.* Revised by *W. T. Hall.* Published by McGraw-Hill Book Co., Inc., New York, N. Y. 447 pages. Price $3.

THE STORY OF CHEMISTRY from the early beginnings down to the present time is told, the text dealing more or less chronologically with the various people important in the unfolding of this story. Chemical knowledge and chemical theories are tied in with much interesting biographical material about the men involved. The brilliant men of every nation receive their due recognition. All of the branches of chemistry including inorganic, organic, physical, colloidal etc. are adequately included. There are many pictures of the men discussed, some of them most interesting. According to the author's preface the aim of the book has been to emphasize that which had historical rather than practical significance. Those discoveries and developments which led to future developments are dealt with extensively while others which were in themselves of value, but did not contribute a new fundamental idea, are dealt with summarily. By carefully studying the workings of the minds of scientists who preceded us, the would-be scientists of this generation should avoid many pitfalls. This book provides an excellent text for such study.

MEDICOLEGAL PHASES OF OCCUPATIONAL DISEASES. By *C. O. Sappington,* M.D. Published by Industrial Health Book Co., Chicago, Ill. 405 pages. Price $2.75.

OF LATE there have been a great many books dealing with the toxicity of various individual industrial chemicals. Therefore, the timing of this book, which is an outline of theory and practice of occupational diseases in general, is particularly apt. The book is divided into four parts. The first contains headings such as causes of occupational diseases, industrial data, gases and vapors, volatile solvents, control of occupational exposures and the cost of occupational diseases. Part II deals with insurance, some practical problems and the importance of prevention. Part III is an entirely medical section giving treatment and prevention as well as estimation of disability. And finally, part IV, which is all legal, gives occupational disease disability laws, difference between accidents and diseases, witnesses and trends of disability legislation.

The book is a clear, concise coordination of the industrial, insurance, medical and legal aspects of the complicated field

of industrial hygiene and occupational diseases.

There are a great many references of value contained in the extensive bibliographies at the end of each chapter as well as an appendix citing abstracts of legal decisions, individual cases and statistics.

INDUSTRIAL PLASTICS. By *Herbert R. Simonds*. Published by Pitman Publishing Corp. New York, N. Y. 371 pages. Price $4.50

Reviewed by *J. A. Lee*

THE PLASTICS INDUSTRY is so new that there are comparatively few books available covering the several phases of the business. And due to the rapid changes that occur in any industry still in its infancy a book is soon out of date. Therefore, this new book is a welcome addition to the bookshelf of the worker and potential user of plastics.

It differs from the other works that have been prepared for it deals principally with applications for plastics. While the chemistry of the subject has been given sound and scientific treatment, still it is not the chemistry of plastics with which the book aims to deal exhaustively. Instead, it describes the various plastics, their composition and their properties, and discusses fully, in practical fashion, the numerous uses to which they are put and the processes by which the applications are worked out.

YEARBOOK & DIRECTORY ISSUE OF MODERN PLASTICS. Published by *Modern Plastics Magazine*, New York, N. Y. October, 1939.

THIS 454 PAGE CATALOG and Directory number of Modern Plastics contains a complete description of the general characteristics of all synthetic plastics from alkyd to vinyl, each treated by a specialist in his field, in easily readable form and embracing developments during 1939, typical applications, trade names and chemical formulas.

The Machinery and Equipment section of the Catalog reveals all recent developments in plant and equipment and the Molding and Fabricating section is devoted to techniques of handling.

A Properties Chart illustrates the comparative physical characteristics of each material, giving softening point, molding temperatures, moisture resistance, thermal conductivity, etc., in tabular form rendering comparison simple.

There is a chapter devoted to Nomenclature which acquaints readers with the terms familiar to the industry and another chapter is devoted to Bibliography which lists all worthwhile printed works on the subject of plastics. The Directory Section gives complete names and addresses of those engaged in the industry, including packaging, equipment and supplies, custom molders, laminators, fabricators and designers; chemicals and raw materials, and trade names of all plastic materials.

This book is profusely illustrated and makes use of a decorative laminated plastic cover, an application of plastics in the field of commercial bookbinding.

CHEMICAL SPECTROSCOPY. By *Wallace R. Brode*. Published by John Wiley & Sons, Inc., New York, N. Y. 494 pages. Price $6.

Reviewed by *E. Henning*

UNLIKE MOST BOOKS on spectroscopy this one by Dr. Brode serves both as textbook and as reference work. In a very comprehensive and detailed representation, he has made available the research and investigation of many spectroscopists. The book begins with the theory of atomic and molecular spectra, a description of qualitative and quantitative analysis, the theory and application of absorption and infrared spectra, the structure of organic molecules in the interesting field of chelate rings, free radicals, etc., and continues with laboratory experiments which include many useful examples of the various quantitative methods. Special chapters on photography and the equipment of a spectrographic laboratory conclude the textual part of the book. A thorough discussion is given to all of these subjects, the scope of which is so extensive that they can hardly be described in a review. Numerous photographs, drawings and graphs are used to illustrate the book.

Special emphasis should be placed on the excellent and complete bibliography at the end of each chapter as well as the tables of the principal lines of elements and the spectrum charts. The author is very successful in his arrangement of the data and tables. Although they will not replace the standard references they give an idea of what is available and can be supplemented by standard books.

Dr. Brode's work certainly fills a gap in the tools of the analyst and scholar interested in spectrographic work. As one of the few books to cover the entire field of spectroscopy thoroughly it will be most welcome to the student and instructor, as well as the research man and industrial worker. It is an excellent treatise and highly recommended for institutions of learning and industrial laboratories.

A PRACTICAL MANUAL OF CHEMICAL ENGINEERING. By *Harold Tongue*. Published by D. Van Nostrand Co., New York, N. Y. 542 pages. Price $12.

Reviewed by *W. D. Kohlins*

THE SUBJECT MATTER of this rather complete text can be divided into three sections. The first might be properties and design of materials of construction, the second, design of chemical equipment and the third, a discussion of certain unit processes. The materials included in the first section are iron, steel, iron and steel alloys, non-ferrous metals and non-metallic materials. Physical and chemical properties are given as well as corrosion data and details of design for the handling of the various materials. There is also one very excellent chapter, containing a wealth of valuable material not easily found elsewhere, on the properties of metals at high and low temperatures.

The material on design is divided into two sections. The first gives details of design, such as methods of welding, soldering, riveting and making joints for the various metals and alloys. Following this there are individual chapters on the design and construction of pressure vessels for the chemical industry, pipes and pipe work. The pressure vessel treatment is complete and well organized and constitutes one of the best parts of the entire book.

Finally, there are the chapters on the unit processes including flow of fluids, heat transfer, evaporation, drying, adsorption, distillation, filtration, crushing and grinding. The section ends with material on heat insulation, steam plants for chemical works and pumping for chemical plants.

A large part of the value of this book lies in the fact that there is put into one volume both the theoretical aspects of the various chemical engineering operations as well as the practical handling of these problems. There are many photographs, diagrams, data tables, nomographs and curves illustrating the material of the text. The author himself stresses in the preface that the whole field of chemical engineering is too vast to cover in one volume and, therefore, he has selected the most important aspects endeavoring to give those phases selected the most practical treatment possible. On the whole, the author has done a capable job and the book will prove a valuable addition to the engineer's library.

USES AND APPLICATIONS OF CHEMICALS AND RELATED MATERIALS. Compiled and Edited by *Thomas C. Gregory*. Published by Reinhold Publishing Co., New York, N. Y. 665 pp. Price $10.

Reviewed by *H. M. Batters*

THIS ROUNDUP of the chemical and process industries is based on data published from time to time over a period of years in the *Oil, Paint & Drug Reporter*, under the headings "Where You Can Sell" and "Industrial Uses of Chemicals and Related Materials." While there are certain blatant omissions, the book does give valuable information and covers a great deal of ground in dealing with about 5,000 chemicals. The products are given in alphabetical order with the industries they serve immediately following each product and also arranged alphabetically. Among the notable omissions are linseed and olive oils. However, this is of lesser importance than a claim made for the book by its advertising literature. It is claimed that the book should be of extreme usefulness to advertising men, salesmen, advertising managers and

manufacturers. This is true only to a limited degree. Because of the alphabetical arrangement of uses there has been no attempt to arrange the uses in order of importance. Much time and money might be wasted by the salesman or manufacturer contemplating manufacturing a product in investigating uses which are, indeed, of such minor significance that they are not worth the endeavor expended. However, this same failing might obviously prove of inestimable value to the patent attorney engaged in research on a chemical case. However, although he might want to know all the uses of a product, at the same time he could hardly object to having them arranged in order of importance.

One apparently useful feature of the work is the indication of all uses covered by patents and the inclusion of the number of the patent covering the specific use.

The cross reference index at the end of the book enables the layman as well as the man versed in the technical vernacular to find his product quickly.

STANDARD CHEMICAL AND TECHNICAL DICTIONARY. By *H. Bennett.* Published by Chemical Publishing Co., New York, N. Y. 638 pages. Price $10.

OVER 25,000 DEFINITIONS and pronunciations are included in this work. The technical works included cover and bring up to date the definitions and pronunciations of terms in the fields of chemistry, engineering, mathematics and physics. Trade names, contractions and symbols are also included as well as commonly used synonyms. The definitions include physical properties of the elements and compounds defined. The most commonly used abbreviations are appended to the end of the work.

The author, a fellow of the American Institute of Chemists and the American Association for the Advancement of Science, is editor-in-chief of the Chemical Formulary, the Standard Book of Formulas and other handbooks in the general range of practical everyday chemistry.

HANDBOOK OF CHEMICAL MICROSCOPY—Vol. 1. 2nd Edition by *E. M. Chamot* and *C. W. Mason.* Published by John Wiley and Sons, New York, N. Y. 463 pages. Price $4.50.

Reviewed by *W. L. Abramowitz*

METALLURGISTS, CHEMISTS, and engineers whose interests carry them to the use of the microscope will welcome this revised edition of their Bible. Volume I is concerned chiefly with the principles of microscopes and accessories and their manipulation. Vol. II, the new edition of which has not yet been published, deals with the application of this optical tool to industrial, analytical and scientific problems. The optical systems of microscopes are considered in great detail and the utilities of the existent types are compared.

It is of great interest to discover the advances in technique which have been evolved since the first edition, particularly those in ultramicroscopy, photomicrography, microprojection and polarization microscopy.

The industrial uses for which details of manipulation are given include abrasives, metallography, colloid chemistry, where diffusion phenomena, cataphoresis, particle size and orientation may be studied, textiles, as developed so well by Prof. E. Schwartz, paints and varnishes. The book is undoubtedly a necessity to any worker employing a microscope.

## METALLURGY

THE MICROSCOPE IN ELEMENTARY CAST IRON METALLURGY. By *Roy M. Allen.* Published by the American Foundrymen's Association, Chicago, Ill. 160 pages. Price $3.

AN ENLARGEMENT of the material presented at a series of lectures at the 1939 Convention of the American Foundrymen's Association in Cincinnati, Ohio, the book is written in simple language that can be understood easily by both the novice and the expert. The first section of the book deals with the value of the microscope to the cast iron foundryman and continues with the fundamentals of physical cast iron metallurgy. The author then embarks on an explanation of the behavior of sulphur and phosphorus in cast iron, how they can be identified in the micro-structure, and their effects on the properties of the iron. The fourth chapter deals with what the author terms special cast irons, such as white, chilled, malleable, and alloy cast irons, explaining variations in properties by use of photomicrographs.

In the next section, the author explains the value and use of equilibrium diagrams. Of special interest should be the equilibrium diagram the author proposes to explain the behavior of cast iron.

In the final chapter, the microscope and the technique of its use are discussed. The various parts of the microscope are explained and the function each performs. In addition, technique in focusing, taking the photomicrograph, photographic processes, photographic papers, etching reagents and sample preparation are discussed. Various types of equipment for grinding, polishing and photographing metal samples are shown.

ALLOY CAST IRONS, a Project of the Gray Iron Division of the American Foundrymen's Association. Published by the American Foundrymen's Association, Chicago, Ill. 270 Pages. Price $3.

"ALLOY CAST IRONS" covers the effect of 18 different elements on the various properties of gray, white and chilled cast irons. Information is given on the effect of these 18 elements on such properties as tensile, transverse, shear, torsional and impact strengths, hardness, deflection, machinability, wear resistance, heat resistance, corrosion resistance, mass and section, electrical properties, thermal properties, chill, etc.

"Alloy Cast Irons" also discusses the forms in which alloying elements are available commercially and the different types that are added to various melting units. General foundry practice used in the manufacture of alloy cast irons, covering such subjects as melting, molding sands, heat treatment, shakeout practice, cleaning and finishing, etc., also is covered.

Of special interest should be the chapter devoted to composition, mechanical properties, uses and service data on many types of alloy cast irons in commercial applications. The 14-page cross index at the rear of the book makes the desired information easily found.

METALLURGY FOR ENGINEERS. By *E. C. Rollason.* Published by Longmans Green & Co., New York, N. Y. 272 pages. Price $3.

THE OBJECT of this book is to provide a condensed description of metallurgical theory and practice, both ferrous and non ferrous. Practical details of specimen preparation are given to enable the reader to carry on macro- and micro-examination of metals. Sufficient production metallurgy has been given to show how properties of a metal depend on the process of manufacture. Young metallurgists and welders should find this brief "primer of metallurgy" useful.

METALLURGY. By *C. G. Johnson, R. S. Dean* and *J. L. Gregg.* Published by American Technical Society, Chicago, Ill. 149 pages. Price $1.50.

IN ANOTHER of our "how-to-do-it" books the authors present in a clear and practical manner the manufacture and behavior of many metals and alloys. It is written in an easy to understand manner and is abundantly illustrated. Among the topics delt with we have selected metals for various purposes, making tensile tests, making chemical tests, microscopic tests, the technique of powder metallurgy, etc.

## TEXTBOOKS

APPLIED ECONOMICS FOR ENGINEERS. By *Bernard Lester.* Published by John Wiley & Sons, Inc., New York, N. Y. 464 pages. $4.

PRIMARILY A TEXT book for engineering students, this book contains much of interest to the man in industry not already acquainted with the principles laid down herein. As the author so often points out, a strictly technical background is not enough for a successful engineering career, except of course, in the case of the scientific genius. The young man going into plant work, laboratory research, production etc. must not only be familiar with the type of work to be done, but with its practicability. Therefore, a general knowledge of principles and methods of planning, human and public relations, industrial organization, problems of both the supplier and

the purchaser and the theory of pricing policies should, according to this book, form one of the essential working tools of the engineer. Once a technical product has been produced it has to be marketed and it becomes an article of commerce no different from any other. Public relations have to be maintained both in the manufacture and marketing of the product. All of these aspects have been capably dealt with and we are provided with not only an informative, but also a distinctly readable book.

AN INTRODUCTORY COURSE IN PHYSICAL CHEMISTRY by *W. H.* and *E. K. Rodenbush*. Published by Van Nostrand Co., New York, N. Y., 461 pages. Price $3.75.

PHYSICAL CHEMISTRY is probably taught more badly and written about more incomprehensibly than any other division of chemical sciences. The authors of the present book have attempted to produce a "streamlined" text with emphasis upon application. In large measure they have succeeded, for the subject matter is intelligible without the aid of a professor. The customary fundamentals are presented including kinetic theory, laws of chemical equilibria, thermodynamics, electrode potentials, and the elements of atomic and molecular structure. To graduate chemists and engineers it may have some value as a reference and re-orientation aid.

A COURSE OF STUDY IN CHEMICAL PRINCIPLES by *A. A. Noyes* and *M. S. Sherrill*. 2nd edition. Published by MacMillan Co., New York, N. Y. 535 pages. Price: $5.

"CHEMICAL PRINCIPLES," (an exact label for physical chemistry) to the reviewer and those others who struggled more or less successfully with the first edition, was known as the textbook of problems interspersed with some explanatory matter. This description is, of course, not as justified as it is vivid. The intent of the authors to make the students think by solving problems which involve more than substitution into convenient formulae is also the dominant feature of the revised edition. The book is divided into three parts, the first of which deals with the general principles relating to matter and energy including the first and second law of thermodynamics; the second is concerned with molecular and ionic theories and the related properties of substances in the vapor, liquid, and solid phases; and the third part studies the rate and equilibria of chemical reactions from the mass action, phase, and energy view points. On the whole this is a book for conscientious supervised study, not for dilettante nor for reference purposes.

LABORATORY MANUAL OF ORGANIC CHEMISTRY. 3rd Edition. By *Roger J. Williams* and *Ray Q. Brewster*. Published by D. Van Nostrand Co., Inc., New York, N. Y. 217 pages. Price $2.

THIS LABORATORY MANUAL was prepared to accompany a text book on elementary organic chemistry and we have the usual series of chemical groups for testing. The particular improvements of this third edition, as the authors point out, are the discarding of experiments of doubtful value; substituting several improved preparations; changes in detail rendering the material easier to follow; and expansion of the material on qualitative analysis to include a large group of compounds and the preparation of solid derivatives. The analytical section stresses identification by chemical means rather than mere recognition, the former procedure demanding more chemical insight than the latter.

INTRODUCTORY COLLEGE CHEMISTRY. Third Edition. By *Harry N. Holmes*. Published by The Macmillan Co., New York, N. Y. 619 pages. Price $3.50.

TWO DIFFERENCES render this text more practical than the average run of textbooks on organic chemistry. In the first place there are abundant references to so-called "living literature," namely the recent journals and periodicals covering the fields of chemistry, chemical engineering and chemical education as well as to many standard authorities of long standing. In the second place, the author tries, and rather successfully, to bridge the gap between classroom theory and industrial practice. The industrial applications are up to date notably in the fields of petroleum refining, synthetic textiles (including nylon and the newest glass fiber), alloy steels, radium and fats. Colloid chemistry and the pages on vitamins have been extended and brought up to date in this edition.

INTRODUCTION TO CONTEMPORARY PHYSICS. Second Edition. By *Karl K. Darrow*. Published by D. Van Nostrand Co., Inc., New York, N. Y. 648 pages. Price $7.

THE DESCRIPTION of the elementary particles and their associated waves, followed by that of the major phenomena explained by the nuclear atom-model forms the main body of this book. The various chapters are built up to amplify this main theme. This book, like many on the same and allied subjects gives not only the standard classical theories of the science, but modern theoretical and practical developments as described in current journals in the field.

## SANITATION

ELEMENTS OF SANITATION. Edited by *E. S. Hopkins*. Published by D. Van Nostrand Co., Inc., New York, N. Y. 435 pages. Price $4.

A WIDE RANGE of subjects is included in this work. A few of these are water supply and sewage disinfection, provision of water supply, problems of sewage disposal, trade wastes control, refuse collection and disposal, control of food, ventilation problems, swimming pool regulations and other important aspects of industrial hygiene.

THERMODYNAMICS AND CHEMISTRY. Third edition. By *F. H. McDougall*. Published by John Wiley & Sons, Inc., New York, N. Y. 491 pages. Price $5.

THIS BOOK was originally written to meet the needs of advanced students of chemistry. It presupposes a fair knowledge of chemistry and physics as well as differential and integral calculus. One of the valuable parts of this work is that the author has tried to maintain a uniformity of nomenclature consistent with best and most common American usage.

THERMODYNAMICS FOR CHEMICAL ENGINEERS. By *Harold C. Weber*. Published by John Wiley & Sons, Inc., New York, N. Y. 264 pages. Price $3.25.

THE INTEREST of the chemical engineer may be purely scientific, but this author maintains that the chemical engineer needs not only the theory of thermodynamics, but the practical and varying applications usually needed by the mechanical engineer. To this end the changes of non-flow nature as well as those of steady flow are given. The book is designed primarily for graduate study although sufficiently advanced undergraduates may find it useful.

## CHEMICAL GASES

THE WAR GASES. Translated from the Second Italian Edition. By *M. Sartori* and *L. W. Marrison*. Published by D. Van Nostrand Co., Inc., New York, N. Y. 360 pages. Price $7.50.

THE USE OF GAS as a war munition has made it necessary for chemists to devote special attention to some of these materials. A few of the compounds treated here include the halogens and halogen compounds, aromatic esters, aldehydes, sulphur compounds, arsenic compounds, cyanogen compounds etc. The data on these gases include chemical and physical properties, methods of production and chemical reactions, detection and analysis methods. This book was written as a result of many actual experiments made in the field during the last war and attempts to show from actual experience the rigorousness and absolute necessity of correlation of physical, chemical technical aspects of these noxious and toxic chemicals. Naturally many of these materials are used for peace-time purposes also and, thus, the book has an added use as an organic chemistry text.

EXPERIMENTAL METHODS IN GAS REACTIONS. By *A. Farkas* and *H. W. Melville*. Published by The Macmillan Co., New York, N. Y. 389 pages. Price $7.50.

THE BOOK is designed mainly to give an account of the methods of investigating all types of gaseous reactions plus sufficient theory to bridge the gap between the theoretical and the practical. It is a book of reference for chemists and physicists dealing with gas reactions. Much data contained herein will find daily service in a laboratory attacking problems connected with reaction kinetics.

# Sulphate Pulp Production

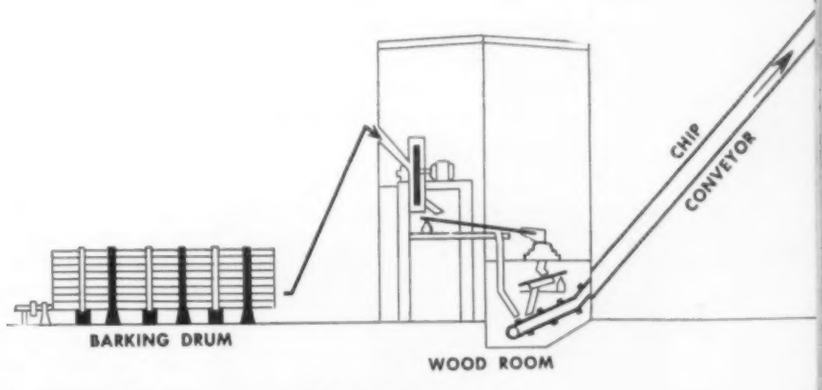
THE EXPLOSIVE EXPANSION in the sulphate pulp industry of the South places this type at the top of the list of chemical pulps in this country. One of the new mills producing sulphate pulp is that of the Kraft Corporation of America, a subsidiary of the Container Corporation of America, at Fernandina, Fla.

The sulphate, or Kraft process as it is also known, depends for raw materials principally on pine wood which grows in abundance in the southern states and in other parts of the country. As it commences its course through the mill the bark is removed. Chippers reduce the logs to small squares which are conveyed to storage bins above the digesters. As required the chips are dropped into the digester in which they are soaked with a mixture of black and white liquors and heated by steam. After 3¼ hours, the contents of the digesters is blown to the cyclone located on the roof. The pulp and steam are separated, the former dropping into one of the diffusers. The steam is then conducted to a separator, which removes any pulp and liquor. The black or spent liquor is washed out of the pulp in the diffusers. The washed pulp is then passed through knotters, screens and thickeners. From the thickeners the pulp drops to the storage tank below and from there it is pumped on to the fourdrinier wire of the pulp drying machine and formed into rolls or sheets. By passing over cylindrical steam-heated dryers the water is driven off. At the end of the machine the sheets are cut, stacked and baled.

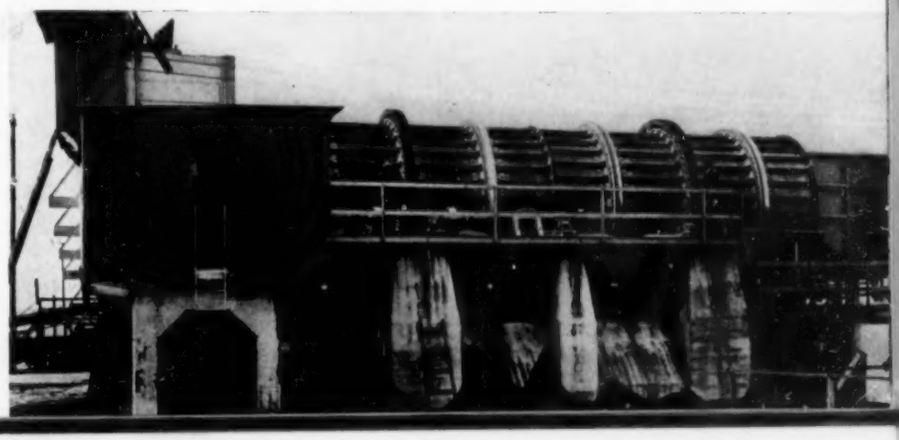
The spent cooking (black) liquor is concentrated and burned to recover the chemicals. Black ash and added salt cake are fed into a furnace called a smelter, from which the molten mass, a mixture of sodium carbonate and sodium sulphate, is run into a tank of water. The solution, green liquor, is causticized, and used as cooking (white) liquor, a solution of sodium hydroxide and sulphide.

The flow sheets commencing on this page and continuing on the following three pages illustrate operations at the mill of the Kraft corporation.

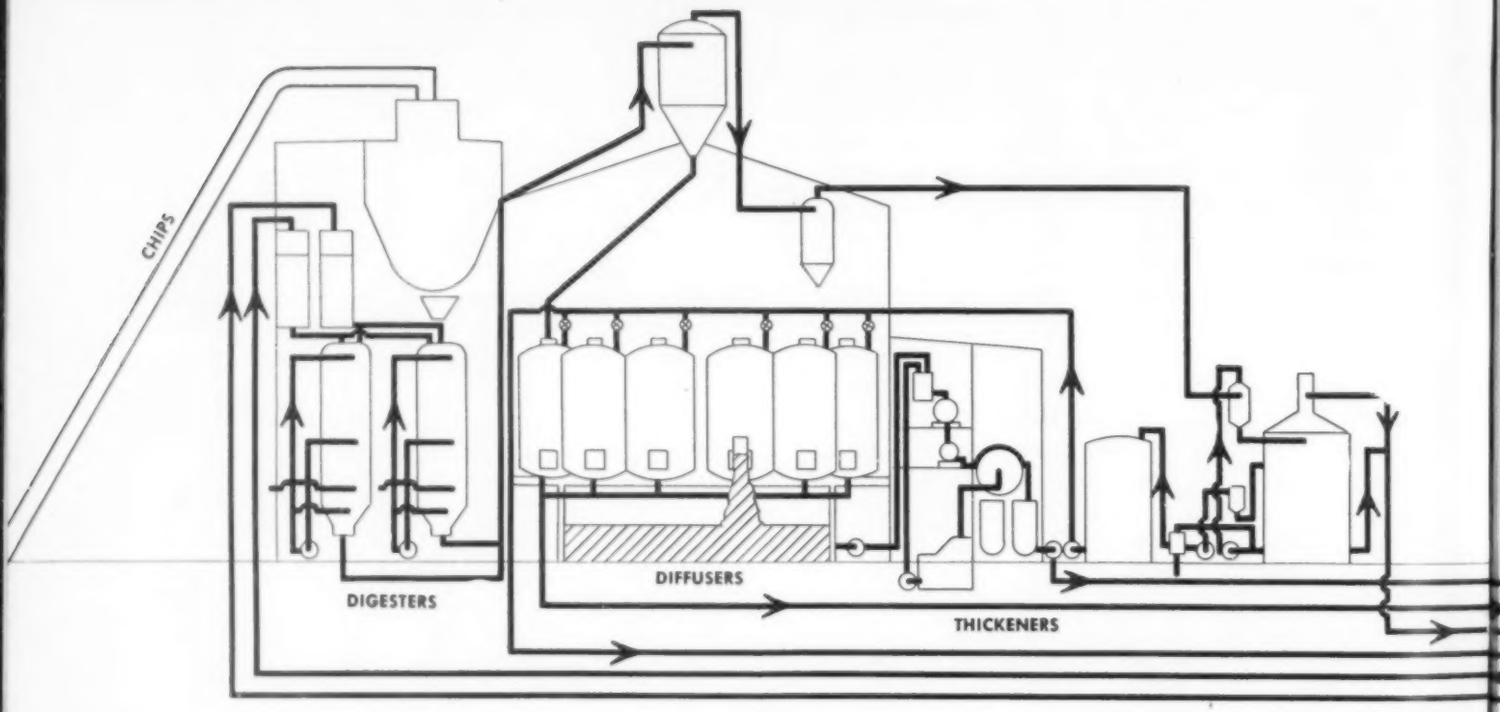
Wood yard and pulp mill of the Kraft Corporation of America, Fernandina, Fla. Pine wood is loaded onto a chain conveyor and carried to the barkers




The logs tumble into a large revolving cylindrical drum to roll against each other, causing the bark to be rubbed off. The logs leave the drum free of bark and dirt. The latter is washed off by a spray of water. A conveyor takes the logs to the wood room where they are reduced in size to small chips

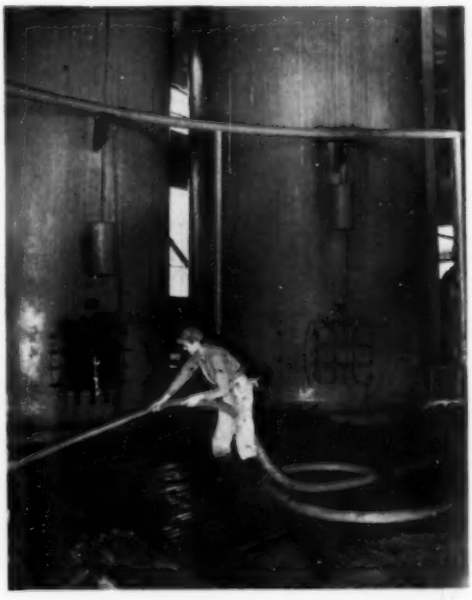


Chips are fed through screens which pass all those of the correct size and reject those which are too large. Chips leaving the wood room are carried by a belt conveyor through a long bridge to storage bins located above the digesters. A lower belt carries the bark to the boiler house where it is used as fuel

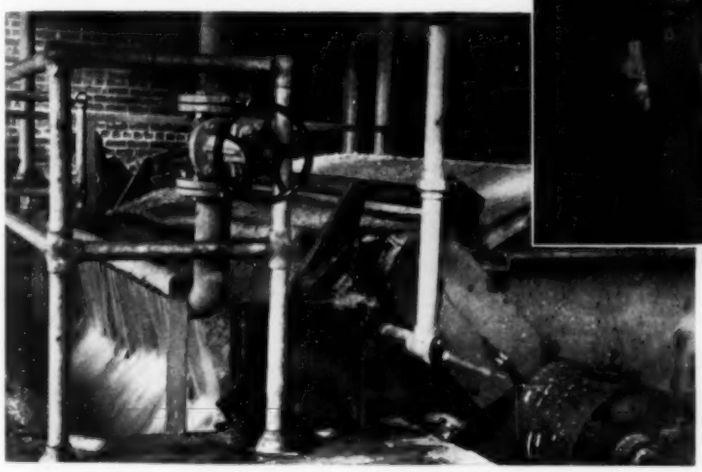


Digesters are first filled with chips, and then a mixture of white and black liquor is run into them from two measuring tanks at the top of the building. 125 lb. steam pressure is then built up. The cooking cycle is about 3¼ hr.

Cooked pulp passes via the cyclone to diffusers to be separated from the cooking liquor. The black liquor is pumped to storage tanks to await recovery of the chemicals for reuse in the process. Washed pulp drops into a storage chest.

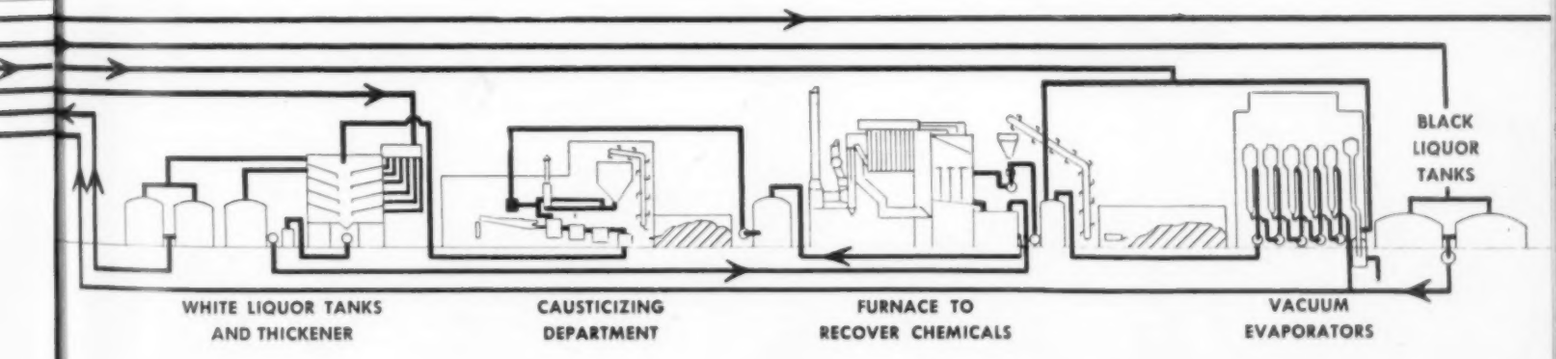


Adjoining the diffuser room is the screen room where the pulp passes through knotters, screens and thickeners. As the names imply, the knotters remove the knots which have failed to cook in the cooking operation, the screens remove any small slivers of wood which remain uncooked, and the thickeners remove water

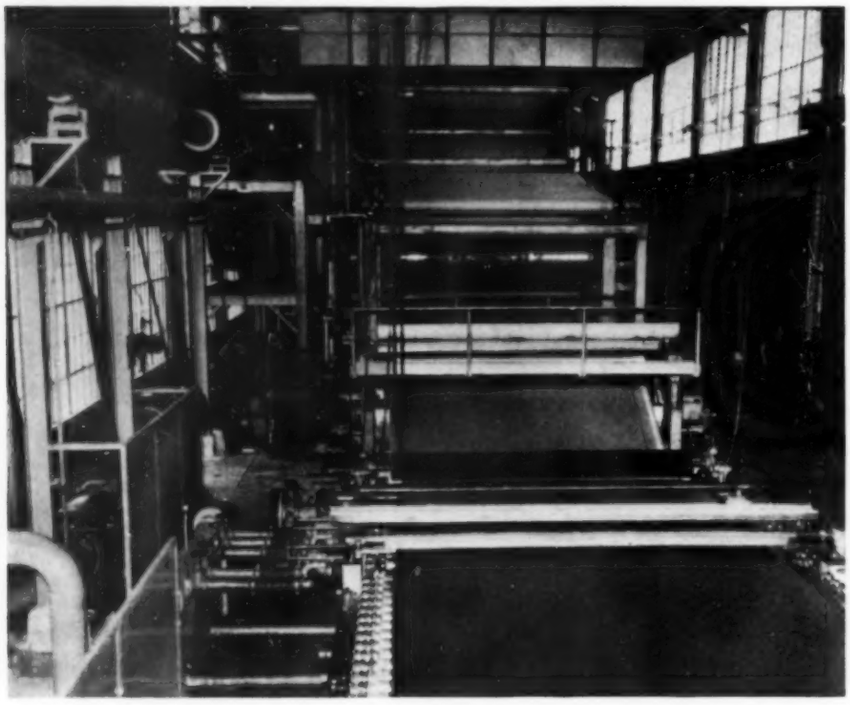


Whereas the knots are discarded, the screenings are made to pass through a refiner which grinds them so that they may be pumped back to the diffuser chest. Pre-screening of this material must take place before it becomes part of the final product. From the thickener the pulp drops to the storage chest below.

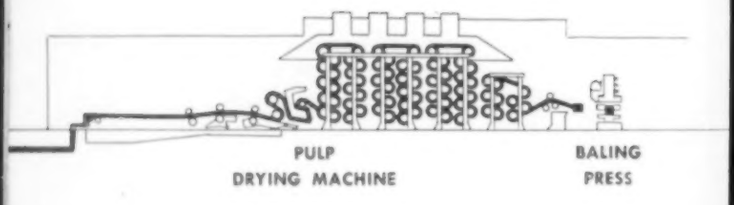
A Chem & Met PICTURED FLOW SHEET

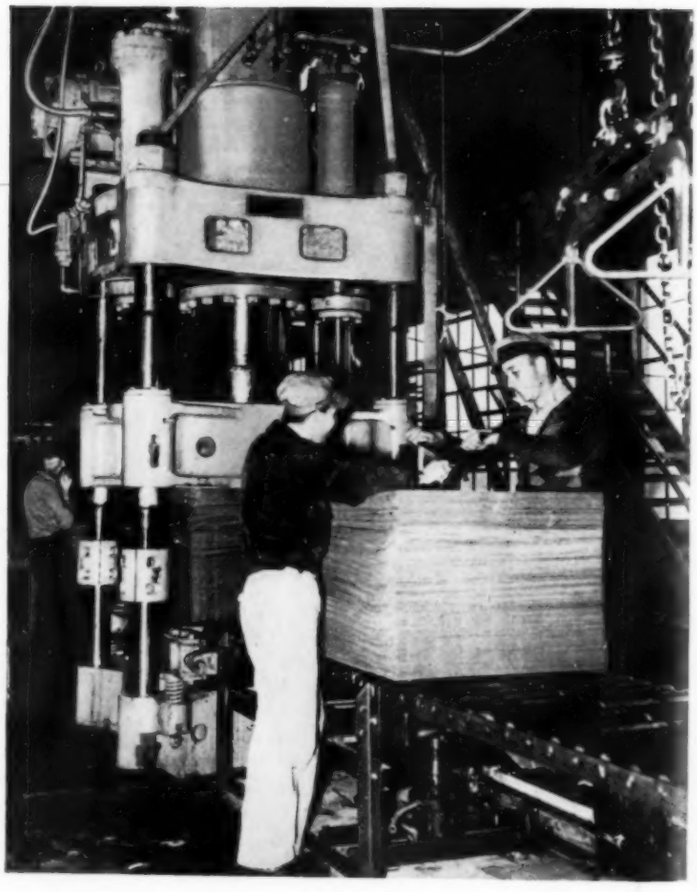



Black liquor, which remains after chips are cooked in the digesters, is separated from the pulp in the diffusers, and from there it is put into storage tanks shown here. From these the liquor is pumped to the evaporating system to be concentrated and goes on to the recovery boiler. Salt cake is added to the liquor just before it goes to the recovery boiler. The high temperature causes a reduction of the salt cake to sodium sulphide.



Pulp is formed into sheets and dried on what is known as a wet machine. The pulp from the screen room chest is pumped to the fourdrinier wire of the pulp drying machine to be formed into the sheets. By passing over cylindrical steam heated dryers the water is driven off. The hood shown at the top of the illustration and in the sketch below collects the moisture.



At the end of the above machine, may be seen the sheets being cut and stacked in piles. A conveyor carries them over a scale and through the baling press. By electric truck, finished bales of 450 lb. of pulp are transported from the machine room to the loading platform where they are loaded into cars for shipment.

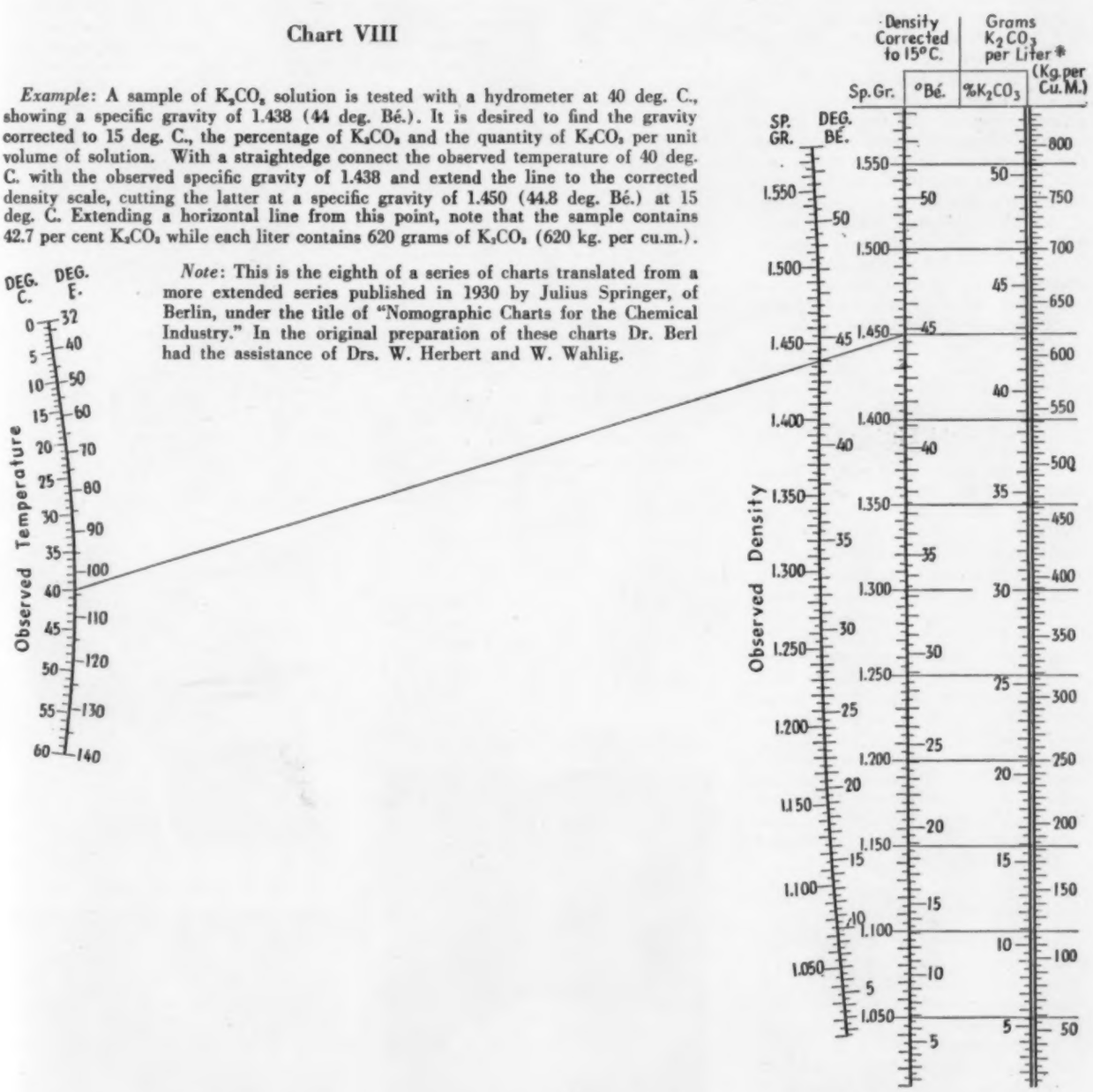
# Nomographic Chart for the Temperature Correction of Potassium Carbonate Solution Densities, With Additional Scales For Interconversion of Physical Data

By ERNST BERL
*Research Professor*
*Carnegie Institute of Technology*
*Pittsburgh, Pa.*

## Chart VIII

*Example*: A sample of $K_2CO_3$ solution is tested with a hydrometer at 40 deg. C., showing a specific gravity of 1.438 (44 deg. Bé.). It is desired to find the gravity corrected to 15 deg. C., the percentage of $K_2CO_3$ and the quantity of $K_2CO_3$ per unit volume of solution. With a straightedge connect the observed temperature of 40 deg. C. with the observed specific gravity of 1.438 and extend the line to the corrected density scale, cutting the latter at a specific gravity of 1.450 (44.8 deg. Bé.) at 15 deg. C. Extending a horizontal line from this point, note that the sample contains 42.7 per cent $K_2CO_3$ while each liter contains 620 grams of $K_2CO_3$ (620 kg. per cu.m.).

*Note*: This is the eighth of a series of charts translated from a more extended series published in 1930 by Julius Springer, of Berlin, under the title of "Nomographic Charts for the Chemical Industry." In the original preparation of these charts Dr. Berl had the assistance of Drs. W. Herbert and W. Wahlig.




*For pounds per cubic foot divide by 16.02.

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# Process Equipment NEWS

## Machinery, Materials and Products

### Stainless Clad Steel

JESSOP STEEL CO., 518 Green St., Washington, Pa., is now marketing stainless clad steel sheets and plates under the name of Silver-Ply. The new ply-metal may be bent, spun into deep heads, deep drawn, drilled and otherwise worked with greater ease than solid stainless, according to the manufacturer. Furthermore, the new material has a better heat conductivity than solid stainless. The process employed in bonding the stainless cladding to the mild steel backing is stated to give an exceptionally good bond, as is indicated in the accompanying view showing a strip of this material twisted into spiral shape without separation of the composite metals. Various degrees of cladding from 3 to 50 per cent are available, with 20 per cent stainless steel and the balance mild steel the most usual.

### Improved Weld Fitting

To SUPPLEMENT its present line of Weld Ells, the Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill., has developed a new seamless forged steel weld fitting the outstanding feature of which is an annular lip forged integral with the fitting which serves to center the fitting in the pipe to which it is to be welded. Thus, a separate backing ring is not required and clamps and guards for holding the fitting in position during welding are eliminated. The new fitting is known as the Centering Weld Ell.

The construction of the annular lip is such that it serves as a streamlined backing ring within the pipe, eliminating any surplus weld metal which might otherwise deposit inside the pipe and produce a roughened wall.

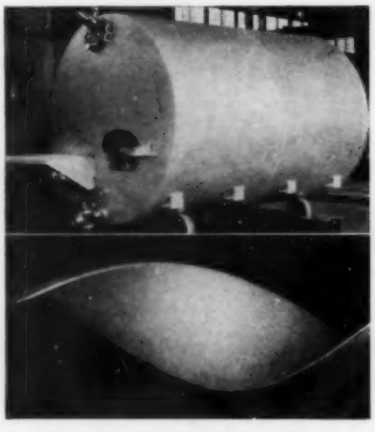
### Motorized Reducer

THE BOSTON GEAR WORKS, North Quincy, Mass., has recently developed a straight-in-line motorized speed reducer, known as Ratiomotor Type SME. This motor is an addition to the earlier line of motorized speed reducers put out by this company. The new unit is available in five output speeds with either ½- or ¾-hp. motors. These speeds range from 108 to 276 r.p.m. The unit is of the double-reduction type, the first stage employing a helical spur and internal gear, the second reduction stage, an internal spur and pinion. All gearing is of high-carbon heat-treated steel, cut after heat treatment. Precision anti-friction bearings are employed on all shafts.

### Flowmeter Totalizer

GYROMETER is the name of a new totalizing device for use with head type fluid meters, recently announced by the Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia, Pa. It will be recalled that the differential pressure produced in the measurement of flow by such primary devices as the orifice, flow nozzle and venturi, is proportional to the square of the flow. Hence all totalizing instruments for use with such meters must incorporate some method of extracting the square root of the differential to be able to record as integrated flow. The new instrument employs a gyroscope for this purpose. This gyroscope develops a force which varies as the square of the speed of the motor driving the gyro unit. This force is used to oppose the pull of a diaphragm subjected to the differential. A switch incorporated in the driving circuit of the gyro motor is likewise controlled by the force of the gyro, so that the frequent make and break of the motor circuit cause it to operate at a speed giving a gyro force equal and opposite to the force on the diaphragm, namely, the differential. Hence, since the gyro force varies as the square of the speed of the gyro motor, and the rate of liquid flow varies as the square root of the differential, therefore the number of revolutions of the motor shaft in a given time is directly proportional to the flow of fluid during that time. The counter that is geared directly to the motor therefore records the integrated flow during the time under consideration.

**Typical Silver-Ply fabricated vessel and test strip showing strength of bond**

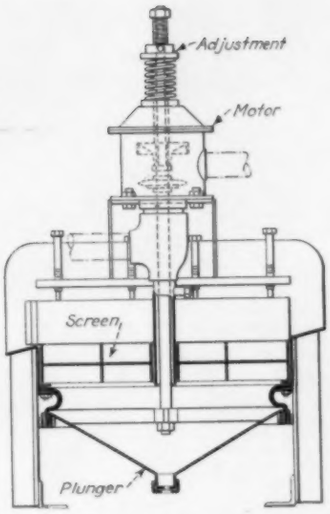


### Improved Jig

AN IMPROVED JIG for the separation of minerals has been announced by the Southwestern Engineering Co., 4800 Santa Fe Ave., Los Angeles, Cal. Known as the Southwestern-Kraut Jig, the new machine features a driving motor which may be run on either air or water under pressure. The apparatus consists essentially of a rectangular tank, open on top, within which is disposed a horizontal

**Seamless weld fitting with annular lip**

**New straight-in-line speed reducer**




**Cross section of new Southwestern-Kraut jig**

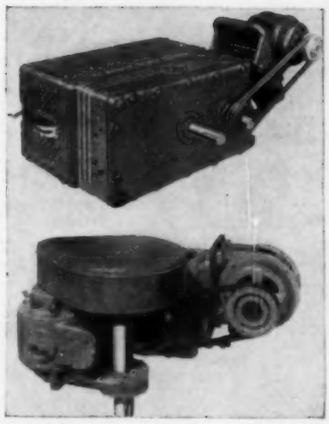
**Convertible 3-in-1 face shield**

screen. To the lower part of the tank is attached a pan plunger by means of a flexible rubber diaphragm. The bottom of the pan slopes toward the center to a concentrate discharge opening. The motor, mounted on top of the jig, is easily adjusted for length of stroke. In a modification of this motor, a specially designed collapsible piston is substituted for the solid metal piston so that dirty water under pressure may be used as the motive power.

The new design is said to be compact and simple, requiring low headroom. Maintenance is claimed to have been largely eliminated and adjustment greatly simplified.

## Variable Speed Drive

A NEW TYPE of infinitely variable speed drive units available for either right- or left-hand installation, with either vertical or horizontal output shafts, has been announced by Mechanical Handling System, Inc., 4700 Nancy Ave., Detroit, Mich. The new units are available in capacities up to 80,000 lb. torque and infinitely variable speed ranges of from 310 r.p.m. forward to 9 r.p.m. reverse, with any standard 1 to 10 hp. motor. Standardized reduction units are available as accessories for further increasing the load capacity of these units. A speed indicator mounted on the outside of the case may



**New variable speed transmissions in horizontal and vertical output shaft types**

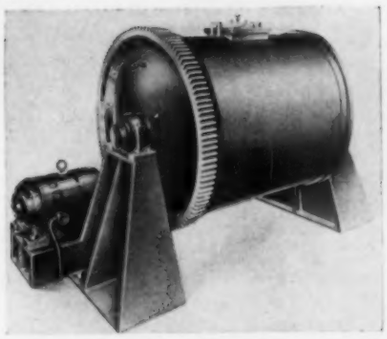
be locked against unauthorized adjustment. Remote control by either mechanical or electrical means is also available.

## 3-in-1 Face Shield

TO PROVIDE PROTECTION against a variety of hazards, the Boyer-Campbell Co., Book Bldg., Detroit, Mich., has developed a combination face shield designed for interchangeability of parts. The head band is provided with snap-on buttons to which a screen, Plastacele or fiber guard may be quickly attached. Thus the same shield may be used for protection against heat with the wire screen, or against various types of welding or other work with the transparent and fiber shield.

## Process Equipment

A RECENT EXPANSION in the manufacturing activities of the H. K. Porter Co., Pittburgh, Pa., has resulted in this company's development of a line of processing equipment including ball and pebble mills, tube mills, agitators, mixers, blenders, autoclaves, kettles, tanks and other equipment. Many new features of design have been incorporated, according to the manufacturer. For example, in this company's ball and pebble mills friction load is reduced by the use of self-aligning roller bearings. Integral motor stands and electrically welded supports are employed. Mills up to and including 36 in. diameter are made with seamless formed disk heads. Jacketed mills have the jacket extending over nearly 100 per



**Typical Porter ball mill**

cent of the mill surface rather than over only a portion of the cylindrical surface.

## Neoprene Belt

FOLLOWING THREE YEARS of research and experimentation, Hewitt Rubber Corp., Buffalo, N. Y., is now manufacturing an all-neoprene friction surface transmission belt which is claimed to withstand the destructive action of mineral oils in fields where oil comes in contact with transmission belting. The new development, known as the Duroil Hewprene transmission belt, contains no natural rubber, both the friction and skim compounds being of neoprene. The new belts are stated to require less takeup and maintenance than rubber belts when exposed to oil and to hold wire fasteners exceptionally well under severe working conditions. The company states that the new belt improves materially over earlier belts developed which had neoprene only impregnated into the outer plies.

## Spring Motor Base

A NEW LOW-COST MOTOR base recently announced by the Ideal Commutator Dresser Co., Sycamore, Ill., employs springs for the automatic maintenance of correct belt tension. This device, which has been named the Automatic, is claimed to be suitable for all types of drives, horizontal, vertical or overhead, and operates satisfactorily with pulsating, steady or reversing loads. Easy adjustment of the spring tension to take up slack in belts from normal wear and stretch is claimed. Through the use of this adjustment, it is further claimed that belts may be changed in as little as 30 seconds.

# MANUFACTURERS' LATEST PUBLICATIONS

**Bags.** Bemis Bro. Bag Co., St. Louis, Mo.—8-page booklet on water-proof bags, answering important questions relating to uses, advantages, construction, filling, closing and other features of such bags.

**Bearings.** Johnson Bronze Co., New Castle, Pa.—Novel plastic and cardboard sliding "size finder" covering over 800 stock sizes of general purpose bearings.

**Bearings.** R. W. Rhoades Metaline Co., 50-17 Fifth St., Long Island City, New York—Catalog 4—16 pages on this company's Metaline bronze oilless bearings with information on types, grades, methods of application and typical uses.

**Belts.** Flexible Steel Lacing Co., 4607 Lexington St., Chicago, Ill.—Bulletin V-200—4 pages describing a new line of alligator V-belt fasteners for B, C and D section V-belts.

**Bentonite.** American Colloid Co., 363 West Superior St., Chicago, Ill.—Data

231-A—Leaflet describing the use of this company's bentonite in the waterproofing of concrete reservoirs.

**Chemicals.** Atlas Powder Co., Wilmington, Del.—Bulletins on Sorbitol, Hexitol derivatives, Mannitol, Zaponite wood finishes and Darco activated carbons. All these bulletins will be available at the Chemical Exposition.

**Chemicals.** Carbide & Carbon Chemicals Corp., 30 East 42d St., New York City—"Fine Chemicals," a 31-page book on 63 organic chemicals recently added to those already made by this company. Complete tables on physical and chemical properties are given, with description and uses.

**Compressors.** Chicago Pneumatic Tool Co., 6 East 44th St., New York City—Bulletin 767—12 pages on a new line of diesel-driven compressors recently introduced by this company in sizes from 770 to 2,340 cu.ft. per min. displacement.

**Dust Collection.** Research Corp., 405 Lexington Ave., New York City and Western Precipitation Corp., 1016 West 9th St., Los Angeles, Calif.—16-page bulletin describing the Multiclone multiple-tube dust collectors developed by these concerns, with information on types, performance, users and applications.

**Electrical Equipment.** Century Electric Co., St. Louis, Mo.—Form 938A—12 pages with information on construction and characteristics of repulsion-start induction motors of the single-phase brush-lifting type.

**Electrical Equipment.** General Electric Co., Schenectady, N. Y.—Publications as follows: GEA-98B, single-phase repulsion motors; GEA-821G, pressure and vacuum switches; GEA-1698A, wound-rotor induction motors; GEA-1807B, squirrel-cage induction motors; GEA-2230A, rotating-cam switches for motor starting and reversing service; GES-2136, 18 pages on little-known products of this company including a variety of instruments for measuring and analyzing many variables.

**Electrical Equipment.** Lewis Engineering Co., Naugatuck, Conn.—Leaflet describing this company's rotary selector switches for thermocouples; also describing a new portable pyrometer for molten metal temperature measurements.

**Electrical Equipment.** Roller-Smith Co., Bethlehem, Pa.—Catalog 9—12 pages on this company's rotary switches for instrument and control applications.

**Electrical Equipment.** Sawyer Electrical Mfg. Co., Los Angeles, Calif.—Catalog A-39—15-page catalog on electrical tools, blowers, portable submersible pumps and motors.

**Equipment.** Stephens-Adamson Mfg. Co., Aurora, Ill.—Catalogs 1339 and 7838—Respectively 8 pages on this company's car pullers, hoists and winches; and 8 pages on Saco speed reducers, with dimensional and rating information. Also Bulletin 1239, brief description of the Tellevel, an electric control for level of solids in bins.

**Equipment.** Sullivan Machinery Co., Michigan City, Ind.—Bulletin 76-R—Describes this company's air-operated single-drum hoist. Also Bulletin R-16, describes anti-freeze systems for portable and permanent air compressor systems.

**Fans.** DeBothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.—24-page book describing more than 200 axial flow pressure fans made by this company in sizes from 8 in. to 10 ft. diameter.

**Filters.** International Filter Co., 325 West 25th Place, Chicago, Ill.—Bulletin 1600—7 pages on this company's disk filters for fine filtration, showing types and applications.

**Furnaces.** Babcock & Wilcox Co., 85 Liberty St., New York City—32-page booklet on water-cooled furnaces showing design details and varied typical applications.

**Furnaces.** Geo. P. Rientjes Co., 2517 Jefferson St., Kansas City, Mo.—4-page booklet describing advantages of this company's supported walls for boiler furnaces in comparison with solid wall masonry construction.

**Furnaces.** W. S. Rockwell Co., 50 Church St., New York City—Bulletin 396—16 pages pictorially describing a wide variety of types of industrial furnace for electric and fuel heat, built by this company. Also Bulletin 397, 4 pages on rotary retort type heat-treating furnaces.

**Grinding.** Abbé Engineering Co., 50 Church St., New York City—Catalog 47—20 pages describing and listing sizes on this company's complete line of jar mills for pulverizing, mixing and blending.

**Grinding.** Cumberland Engineering Co., Kingsport, Tenn.—8-page bulletin describing the new Cumberland grinding and granulating machine, a screen-type cutter operating on a new principle.

**Heat Exchange.** Griscom-Russell Co., 285 Madison Ave., New York City—Bulletin 1219—8 pages on this company's K-Fin extended surface air coolers for the cooling of air, hydrogen and industrial gases.

**Instruments.** The Brown Instrument Co., Philadelphia, Pa.—Booklet 2-17—8 pages describing this company's new line of redesigned recording and indicating thermometers and pressure gages.

**Instruments.** The Esterline-Angus Co., Indianapolis, Ind.—Bulletin 839—12 pages on construction and use of this company's recording wattmeters.

**Instruments.** Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.—Group of leaflets on various applications of photocells to automatic control, covering counting, smoke detection and a variety of other applications.

**Instruments.** Wheelco Instruments Co., 1929 South Halsted St., Chicago, Ill.—Bulletin 2850-1—4 pages describing a new surface pyrometer recently introduced by this company.

**Linings.** Homogeneous Equipment Co., Downingtown, Pa.—4-page folder illustrating types of equipment provided with homogeneous linings in lead, tin and other metals by this company.

**Lubrication.** Bijur Lubricating Corp., Long Island City, N. Y.—Bulletin J—8 pages briefly explaining 14 reasons for the use of automatic lubrication.

**Materials Handling.** Yale & Towne Mfg. Co., Philadelphia Div., 4630 Tacony St., Philadelphia, Pa.—Bulletin P-442—60-page catalog on this company's materials handling equipment including lift trucks in a wide variety of types, both hand and motor operated, as well as skid platforms.

**Metal and Alloy Properties.** The Cambridge Wire Cloth Co., Cambridge, Md.—Bulletin 76—32 pages describing in considerable detail chemical and physical properties of metals and alloys employed by this company in the manufacture of wire screens, cloth, and wire conveyor belts.

**Ovens.** Precision Scientific Co., 1750 North Springfield Ave., Chicago, Ill.—Bulletin 305—8 pages discussing in considerable detail considerations involved in choice of constant temperature ovens, particularly for laboratory use.

**Power Transmission.** Allis-Chalmers Mfg. Co., Milwaukee, Wis.—This company's house organ, "Texrope Topics", appears in a new large format. Devoted to applications of V-belt drives.

**Power Transmission.** American Leather Belting Assn., 100 Gold St., New York City—Spiral-bound handbook and catalog on automatic-tension-control, short-center, pivoted-motor, leather belt drives. A 40-page section gives information describing advantages of such drives as determined by research, together with extensive drive selection tables and list prices on endless leather belts. Supplementing this is a pictorial section illustrating and describing numerous applications arranged by industries, together with catalogs on wood, paper and metal pulleys and on pivoted motor bases. Copies may be obtained from individual members of the association, pivoted motor-base manufacturers, or the association itself.

**Power Transmission.** Reeves Pulley Co., Columbus, Ind.—Bulletin G-3914—4-page leaflet illustrating the basic types of this company's speed control equipment, showing various modifications and methods of controlling and suggesting typical applications.

**Pumps.** Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin B-6018—35-page book describing this company's close-coupled centrifugal pumps, showing various styles and types and giving information on applications, performance, dimensions, and calculation of pumping head.

**Pumps.** Granberg Equipment, Inc., 4068 Holden St., Oakland, Calif.—Series of leaflets describing this company's positive displacement rotary pumps in types for handling gasoline, liquid butane and other volatile liquids.

**Pumps.** The LaBour Co., Elkhart, Ind.—Bulletin 48—8 pages describing in detail this company's new Type R self-priming centrifugal pump for chemical and hydraulic service.

**Pumps.** Roots-Connersville Blower Corp., Connersville, Ind.—Bulletin 260-B11D—6 pages describing in considerable detail this company's industrial turbine pumps, with information on typical applications.

**Regulators.** The Foster Engineering Co., 109 Monroe St., Newark, N. J.—Bulletin 2—8-page bulletin describing six types of spring and weight-loaded pressure reducing regulators made by this company for steam, air, liquid and gas pressures.

**Safety.** Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich.—4-page folder describing a variety of face shields made by this company for eye and face protection.

**Silica Gel.** The Davison Chemical Corp., Baltimore, Md.—34-page spiral bound bulletin on "Protek-Sorb", a variety of silica gel used for protection of numerous products against moisture during storage and shipment.

**Traps.** Armstrong Machine Works, Three Rivers, Mich.—Catalog H, First Edition—New "Armstrong Steam Trap Book," a 38-page catalog and educational handbook on condensate drainage, including much information on trap types, trap applications, special trap kinks, and engineering data.

**Valves.** Edward Valve & Mfg. Co., East Chicago, Ind.—8-page "picture-paper" presentation of news in valves selected from recent developments of this company.

**Water Treatment.** The Permutit Co., 330 West 42d St., New York City—Bulletin 2233—8 pages describing in detail this company's "Electro-Chemical" feed, available in variable-rate, proportioning feed units, and constant-rate feed units for uniform flow.

**Welding.** Stoody Co., Whittier, Calif.—Catalog 106—48 pages on this company's products, including hard-facing metals, tungsten carbide in various forms, welding rods, grinders and accessory equipment.

**Welding.** Wilson Welder & Metals Co., 60 East 42d St., New York City—16-page catalog on this company's Hornet arc-welding generators with information on design, characteristics, construction details and specifications.

# Chemical Engineering NEWS

## Regional Laboratories Dedicated

Three of the four regional laboratories of the Bureau of Agricultural Chemistry and Engineering have been dedicated. The first cornerstone ceremonies took place at Peoria, Ill., on Oct. 18 before a gathering of about 500 leaders in agriculture, government, and industry. Dean W. C. Coffey, director of the Minnesota Agricultural Experiment Station presided at the laying of the cornerstone and Henry A. Wallace, Secretary of Agriculture was the principal speaker. Secretary Wallace identified the four regional research laboratories as symbols of the first nationwide attempt by the government to search out new and industrial uses for farm products. He emphasized the importance of the pilot-plant aspect of these laboratories as a means of speeding the adaptation of research findings to commercial industrial practice. He cautioned against too eager anticipation of immediate results and pointed out that time and patience were important factors in working out and carrying through to completion of a research program.

In the evening following the laying of the cornerstone, Secretary Wallace addressed an audience of about 1,500 in the Peoria Shrine Auditorium on the economic importance of these laboratories in relation to the national farm program. He cited their activities as only a phase of the broad program in which human and soil conservation are the first considerations.

Secretary Wallace also delivered the principal address at the cornerstone-laying ceremony at the new western research laboratory in Albany, Calif., on Oct. 27.

## International A.C. to Increase Production of Potash

The International Agricultural Corp., New York, has sold $1,208,000 of its treasury bonds, these funds to be used as an additional investment in Union Potash & Chemical Co. to complete that company's financing and mining program and enable it to be in production next year. The Union company is controlled and managed by International.

For approximately three years the research and engineering facilities of International Agricultural Corp. have been concentrated on the development of the possibilities of Union's New Mexico potash deposits. As a result it has developed ample tonnages of ore and has a complete program for the mining and processing of the potash minerals. The plan contemplates the use of the most modern mechanical equipment for mining up to 2,000 tons of ore per day. By use of its advanced metallurgical processes it is estimated that the Union company will produce and make available to the market approximately 70,000 tons of potassium sulphate and also an equal tonnage of 60 per cent muriate per year. In addition, the processes provide sufficient flexibility to permit production of any grade or type of potash salts, either as such, or in combination with soluble magnesium salts. Further plans for the production of profitable byproducts are at present being brought to a state of perfection.

This development will provide the first mine to produce potassium sulphate direct from native ore in the United States. The proposed methods and processes for potash production have been proven to the satisfaction of International's technical staff and also have been checked and approved by well-known independent consultants.

## Monsanto to Build Plastics Research Laboratory

Immediate construction of a new plastics research laboratory in Springfield, Mass., by Monsanto Chemical Co. was announced at the beginning of the month by J. C. Brooks, vice-president in charge of the Plastics Division.

The new building, designed to house the company's research staff and laboratory facilities, will be the first structure at the Springfield plant designed exclusively for research activity. This makes possible a number of unique innovations in construction, including a system of piping and conduits that will permit rearrangement and revision of laboratory facilities to take care of the requirements of almost any type of plastics research problem.

The ground floor will house the general offices of the research group under the direction of T. S. Carswell, director of development and research, and also will have locker and shower rooms. The upper floor, with the exception of a complete reference library, will be devoted to laboratories, both individual spaces for chemists, assigned to special research problems, as well as large laboratories for problems and developments being worked on by groups.

Mr. Brooks stated that the new laboratories have been designed and located to allow for expansion when warranted. Although no plans are in process for further construction, it is anticipated that a pilot plant may be built adjacent to the laboratory where new processes may be tried and proved in small-scale operation before investments are made in full-size equipment.

## Armour and Lewis Institutes Will Consolidate

It has been announced by James D. Cunningham, chairman of the board of trustees of Armour Institute of Technology, and Alex. D. Bailey, chairman of the board of Lewis Institute, that their respective institutions had entered into an agreement to consolidate into a new technological center for Chicago. This is the first occasion on which two colleges of engineering have ever agreed to merge their interests to produce an institution of more important scope.

The name of the new school is to be Illinois Institute of Technology, with the background and reputation of the two component colleges recognized by maintaining their names as applied to its two divisions. The actual consolidation of the educational program will be complete by September, 1940, and the balance of this year will be given over to planning an integration of activities. For the time being, it will be necessary to operate both the Armour and Lewis plants, but the complete development of the new center of technology contemplates the acquisition of a new, well-planned campus, conveniently located, to meet the needs of its broad objectives.

## A.S.M.E. to Hold Annual Meeting in Philadelphia

Broadening the usefulness of the mechanical engineering profession will be the keynote of the 60th Annual Meeting of The American Society of Mechanical Engineers to be held in Philadelphia, Dec. 4-8, 1939, according to an announcement made by Nevin E. Funk, vice-president of the Philadelphia Electric Co., and chairman of the general committee arranging the meeting. An attendance of more than 3000 mechanical engineers is expected.

All functions of the 60th Annual Meeting, the first held outside New York City since 1890, will take place at The Bellevue-Stratford Hotel. Present plans call for 35 technical sessions at which 105 papers will be presented; a get-together smoker and introduction of 1940 officers of the Society on the evening of Dec. 5; the annual banquet and conferring of medals and awards on Wednesday, Dec. 6; college re-union luncheons and dinners for engineers on Thursday, Dec. 7; and the Fourth Annual A.S.M.E. Photographic Exhibit all week.

# NEWS FROM WASHINGTON

**Washington News Bureau**
**McGraw-Hill Publishing Co.**
**Paul Wooton, Chief**

WAR business is being appraised in Washington critically. There are a surprising number of compliments that business men have not allowed this baby boom to get out of hand. And there are plenty of forecasts that present business is so largely for inventory, so little for immediate consumption, that any boom bubble may well burst early in 1940.

The stability of chemical prices has been one of the notable factors commented on. With the exception of a few commodities which were seriously interfered with by discontinuance of imports, Washington has heard little complaint, an amazing contrast with the World War experience of the Capital. Washington notes also that the chemical industries are justifiably skeptical as to their prospect for taking over any great quantity of new export business in areas which Germany has been forced to abandon through interference with sea trade.

### Emergency Bosses

Planning for the problems of industry in the event of further emergency is continuing. Whatever merit the Stettinius war industries program has, this is largely offset by various types of political effort being exerted by conflicting factions. At the beginning of November, it looks as though all of the hopes fondly based on the theory that a Stettinius type of board would govern in the event of war are beginning to collapse. Radical shakeup in various military units is talked of, none too quietly. The controversy between leaders in official position appears momentarily about to break into the open.

Those who know that somebody must be ready to handle various jobs, if we should meet a real war emergency, are bringing in reserve officers in large numbers, are working with civilian units, are struggling with new possibilites for war industry direction. It is much less certain now than a month ago that business men accustomed to handle big projects will ever be in charge of such planning and war-time direction, should an emergency unfortunately come.

### Strategics Buying

Bids opened in late October have permitted government orders for tungsten ore amounting to about $425,000. This purchase is of Chinese ore of requisite quality which will be brought promptly from China, assuming no serious difficulty in direct transport handling. Chromium offers from domestic sources were not satisfactory and the government has had to start some new negotiations with importers of that ore. Two bids for manganese ore were accepted by the Treasury on Oct. 31, one for $180,000 worth of domestic production and the other for $765,000 worth of Cuban ore to be brought in by Cuban American Manganese Corp., a subsidiary of Freeport Sulphur Co.

In the aggregate, these strategic mineral purchases are much less than half the expected expenditure and further contracts will be arranged if practical. Bids for pig tin are being opened Nov. 6 and the government hopes that contracts can be let for that most essential metal within the current month.

Bids are being taken from manufacturers of optical glass on confidential specifications. It is hoped that the requisite supply of this material can be contracted for very soon. Offerings of up to a million ounces of quinine sulphate will be considered in another bid opening of Nov. 15. One of the early requests for strategic material bids on manila fiber (abaca) had to be withdrawn, for reasons not stated officially. It is evident that this buying of strategic materials is proving even more difficult than officials feared, as a result of much congressional delay in granting authority for stock pile building.

### Defining "Monopoly"

TNEC "struck oil" when it had petroleum executives on the witness stand during October. It is evident that some of the testimony regarding the new types of competition of industry were both informative to some of the legislators and encouraging to the anti-monopolists of the committee. The result appears likely to be a new effort by this latter group to define those sorts of merchandizing practice which they regard as objectionable, and to forbid them by new law.

In several other fields of Washington activity it appears that the neutrality "honeymoon" between officialdom and big business is approaching an end. As Congress fixes up this bill and goes home, there is likely to be renewed activity in the pressing of various reform programs. A vigorous new attack on the whole fuel field is expected from Mr. Ickes, who has lately been speech making regarding the inter-fuel competition and the way some fuels must be restrained in order that others may live profitably. This theme song, of course, is intended to woo the Lewis-led United Mine Workers back to a friendly relation with the New Deal. If it succeeds, the result will be higher fuel costs for industry. The present Washington guesses are that Lewis dislikes the New Dealers so much that he will sacrifice a chance to gain for coal in order to oppose his official enemies.

A slightly comforting significance for process industry is the recent effort of the Department of Justice to prevent the railroads from monopolizing transportation by handicapping motor carriers of both freight and passengers. The suit, started in a District of Columbia court, looks like at least a temporary obstacle to the stifling of highway transport.

### Regional Labs Progress

During late October the cornerstone was laid at three of the new Regional Research Laboratories of the Department of Agriculture. The fourth (New Orleans) will have its ceremony early in December. Construction progress is going about according to schedule and the research staffs are hoping that they will have a place ready for equipment by mid-summer. Full experimental activity cannot be expected until about a year from now.

Almost weekly there have been announcements in Washington of appointments to the more important research posts of these four institutions. Several outstanding chemical engineers have been named as project leaders. Intensive study on the experimental programs, the needed scientific and engineering equipment, and the plans for industry cooperation are actively under way. Any chemical firms that have important ideas regarding these projects are encouraged to take up the matters of mutual interest promptly. Arrangements should be made through the Washington headquarters of the Bureau of Agricultural Chemistry and Engineering, where all of the principal staff men are necessarily located until the regional buildings are completed. At two of the laboratory dedications, Secretary of Agriculture Wallace made addresses, discussing the Department policy and the general scientific and engineering program contemplated.

### News "Fines"

New Tariff Fight—Secretary of State Hull is hustling further tariff cuts under the trade agreement program. He must get any new agreements into force before the present law expires next June. He hopes, probably vainly, that a revised Belgian agreement will replace the defunct Czech treaty. It may also add more important chemical and process industry tariff cuts if consummated. More probable

of enactment are the results of negotiation with Venezuela, the Argentime, Chile, and Uruguay. Several important industrial fats and oils are involved in the Argentine and Uruguayan proposals. The Chilean list of commodities to be considered includes a number of chemical importance, as follows: argols, calcium tartrate, copper compounds, guano, sodium nitrate, potassium nitrate, iodine, sodium sulphate, and sulphur. Most of these chemical items are on the free list so that the worst that can happen would be a binding of the commodities there by treaty for a period of years, probably not exceeding five.

Seasonal Labor—At last one process industry gets a little comfort from the Wage and Hour Division of Labor in the proposal that labor in the Louisiana sugar industry be regarded as "seasonal" under this law. This group is so defined largely because the employees are not only so engaged during a limited time each year, but also because this same personnel does not secure other employment in the same or related industry in other functions during other parts of the year. Other kinds of industry having highly seasonal characteristics have been turned down in their request for the hour exemption because the workers so engaged briefly for long hours are during other times of the year engaged in other sorts of employment by the same or related enterprise.

Wage Fixing Continues—The Secretary of Labor had a sharp setback in the courts which ruled that fixing minimum wages for employment on government contracts (under the Walsh-Healey law) could not be carried out as planned in the steel case. Despite that decision, which is being appealed, other wage fixing is proceeding. One case of greatest interest to chemical industry is the group of minimum-wage decisions fixed for the explosives industry. Those engaged in the manufacture of explosives must be paid 57.5 cents per hour, those making blasting and detonating caps, 47.5, and those working in the primer and related activities, 42.5, to meet the law. Regardless of the outcome of details of the steel wage decision, it is likely that this Walsh-Healey law technic will continue to govern contractors on government business.

Potash After April—Washington now guesses that the real pinch on potash supply will come next April when the fertilizer company stocks are exhausted and the spring shipping season is well under way. Officials of the industry reply that before then the industry will have picked up the whole load, canceling its present export market to make sure that there are no shortages of this fertilizer chemical in the United States. Meantime a few potash specialties are debated with some heat, including particularly pure chloride, chlorate, and occasionally sulphate.

Textile Tester—New apparatus for measuring thermal conductivity of textiles has been announced by the Bureau of Standards. This gives a technic for direct measuring of heat transmission through fibrous and sheet materials at any predetermined test temperature. The technic appears to be applicable to all sorts of sheet goods of interest to process industry, not alone to bed blankets and woolen suitings.

Triple Superphosphate Bids—Eight companies offered on Oct. 24 to furnish an aggregate of 61,600 tons of high concentration superphosphate, "triple-super", on forms of AAA requesting bids up to 70,000 tons. Prices of the offerings range from 57 to 73 cents a unit in bulk, with bagged material ranging from 2 to 7 cents a unit higher, depending on the type and size of bag. Contracts covering the total available material are expected. The product will be used by AAA for delivery to farmers cooperating in the Soil Conservation program.

## Potash Land Leases Offered At Auction

On October 19 the Department of Interior held an auction for the leasing of 6,340 acres of public land in California where potash development was contemplated. The proposed land was offered in six parcels, varying in size and value. In announcing the request for lease bids, the Department made the following provisions: Lessees would be required to make a certain minimum investment on each parcel. For three of the parcels the minimum investment contemplated was $50,000, for the other three, $200,000 each.

The lessee would be required to drill wells and continue production for the protection of the government-land brines or to compensate the government by suitable royalties in the event of drainage losses resulting from operations on adjoining property.

The royalty required by the government was 3 per cent of the gross value, f.o.b. shipping point, with a guaranteed minimum production for royalty in the second full year of potash valued at not less than $33.33 per acre. Even if operation did not produce such values subject to royalty, the lessee was to be required to pay a minimum royalty equivalent to such production.

The bidding was to be in the form of the bonus above royalty per acre offered by the bidders. The Secretary in making the announcement indicated that he expected a minimum bonus of at least $5 per acre on one plot and a minimum of at least $10 per acre on the other five plots.

At the auction there were two bidders, American Potash & Chemical Corp., Searles Lake, Calif., and West End Chemical Co., San Bernardino, Calif. The former company, at present operating in nearby areas, was the high bidder on four of the parcels, offering $15, $16, $20, and $30 per acre, respectively. West End Chemical Co. was high bidder on the two other areas, offering $13 per acre for one and $261 per acre for the other. This very high bid resulted from the fact that this particular parcel, known as Unit No. 48 or California Parcel No. 19, was advantageous both geographically and geologically. Apparently this parcel adjoins an area now being actively worked by American Potash and Chemical Corp. The geologists who have studied this area have also estimated that it will be the most productive of high-quality brines.

## France Frees Some Chemicals From Export Restrictions

The exportation or reexportation from France of additional chemical products, fixed vegetable oils, unperfumed soaps, calf skins, industrial diamonds, and truck chassis weighing from 1,500 to 5,500 kilos each is to be permitted only under authorization from the French Minister of Commerce, by a decree of October 27, according to a cablegram received in the Department of Commerce from the American Embassy at Paris.

At the same time, the following commodities were removed from the list of products subject to export license: Zinc ore and metal, spectacle glass, sodium hypochlorite, hydrate of alumina, sodium chloride and a number of other chemical products.

All French export restrictions are in force also in Algeria, the French colonies, protectorates and mandated territories.

## Junior Chemical Engineers Will Hold Open Meeting

The Junior Chemical Engineers of New York will hold an open banquet meeting on Tuesday, Dec. 5, at the Rogers Smith Restaurant, 40 East 41st St. The annual banquet is being held at this time in order that it may serve as a get together for students and young chemical engineers who are in the city for the Chemical Exposition. S. D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering*, will speak on the subject "New Opportunities for the Chemical Engineer."

## Monsanto Win Massachusetts Merit Awards

For developing two new types of plastics materials which were placed on the market during 1939, Monsanto Chemical Co's. Plastics Division at Springfield, Mass., has been honored by the Associated Industries of Massachusetts. Roy F. Williams, general manager of Associated Industries of Massachusetts, announced that Monsanto had been selected for Merit Awards for the development of polyvinyl acetal resins for making the new high-test automobile safety glass, and for similar work in making widely available a new type of plastic molding material, polystyrene.

## GERMANY INTENSIFIES SEARCH FOR METALS, GRAINS, MINERAL OILS AND OTHER MATERIALS

Special Correspondence

WHETHER and to what extent the Soviet Union will supply German industry with sorely needed raw materials is a question closely followed in the Reich and elsewhere. All but isolated from the countries which supplied 50.1 per cent of her import needs the first six months of this year, Germany is taking steps to cut down demand for imported raw materials and to intensify her trade with accessible contiguous and neutral countries.

Provisions of the Russo-German trade pact of Aug. 19 with its long-term credit to the Soviet Union of 200 million RM is being rushed, and the goal is to bring trade back to the high level of the early 30's. Raw materials which Germany hopes to get are grains, timber, mineral oils, ore, and flax. Part of present Russian petroleum production of 30 million tons could be diverted to the Reich, and Polish and undeveloped Russian reserves may be tapped with the aid of German engineers and equipment. Germany also has an eye on the U.S.S.R.'s mineral deposits. Ore production, which is now behind the Third Five-Year Plan quota, it is hoped, can be speeded with the delivery of German mining equipment. These developments will take time and assume that Russia is willing to cooperate. Cotton for the Reich's textile industry may also come partly from Russia, which has expanded production in the last few years so that it is the world's third largest producer. This still leaves Germany without rubber and tin, important items imported from the British and French Empire, which supplied 18.8 per cent of the Reich's imports the first half of this year. To what extent these and other vital materials can be obtained from other neutrals is an open question.

What can Germany offer Russia since she obviously does not have cash with which to pay for raw materials? The answer partly depends on whether Russia will be willing to take long-term deliveries. That all Germany's production will be needed for war purposes and leave a shortage of goods capable of being exported is not entirely the case. For instance, some goods formerly exported to countries with which Germany is now at war and to neutral overseas countries can be diverted to the Soviet Union. Russia could use diversified consumption goods as highly specialized machinery, optical goods and chemicals. Chemicals may play an important part in this exchange, for the Soviet Union's chemical industries have suffered from the government's attempt to expand production at a more rapid rate than technical knowledge and experience would permit. Most important basic chemicals which the U.S.S.R. produces are potash fertilizers, superphosphates, apatite concentrates, and soda ash.

The decline in Germany's trade with Russia from 763 million RM exports in 1931 to a low of 32 million RM in 1938, and of imports from 436 million RM to 47 million was not due alone to political differences. Economic structural changes in the two countries partly account for this shrinkage. The U.S.S.R. has now developed its industries to the point where it no longer wants to import quantities of mass produced goods. Higher German prices coupled with delays of nine to twelve months in delivery of machinery, for instance, also discouraged trade. Shortly before the war, however, the growing political tension between Germany and other primary producing countries, including the United States, with which the Reich has constantly had a passive trade balance, gave impetus to Germany's attempt to revive trade with the U.S.S.R. It is of interest that the main part of negotiations in Berlin and Moscow on the German side was carried on by industrialists and not Foreign Office representatives.

In 1931 when Russo-German trade was at its best, machinery and iron products were the main items imported by the U.S.S.R. Chemicals and pharmaceuticals accounted for 16.5 million RM of the total imports. Germany's chief import items were grains, skins and hides, mineral oils, and ores, including especially manganese, in which the Soviet Union now supplied two-thirds of world production. Nickel, tungsten, chromium, vanadium, molybdenum, and titanium are other metals found in Russia, to say nothing of iron ore. The 30 million tons of iron ore mined last year had an iron content of 15½ million tons, as against only 2.8 million tons iron in the 9.8 million tons of ore mined in Germany in 1937. The high grade ore mined around Krivojrog, not far from the Donez coal basin, with 55 to 65 per cent iron content, for some time after the world war was sent, in spite of the great distance, to Westphalia in Germany for refining.

Southeastern Europe remains another source for Germany of raw materials, except cotton and rubber. In 1938 Germany's share of the total trade of the Balkan countries was as follows: Hungary 48.1 per cent of total imports came from Germany (50.1 per cent of its total exports went to the Reich), Jugoslavia 50 per cent (49.9), Rumania 49.9 per cent (36.1), Bulgaria 57.9 per cent (63.6), Greece 30.6 per cent (41.5), Turkey 50.8 per cent (46.1), respectively.

In addition to trying to expand Russian, Southeastern European and Baltic trade, several measures have been taken in Germany to conserve raw materials. As early as the middle of August a special commissioner was appointed for the coal industry. Coal for household use is curtailed to take care of increased use for transport and industry. The acquisition of Polish Upper Silesian mines will boost production considerably and help to counterbalance losses in Saar production.

Civilian consumption of products requiring imported raw materials has been limited through rationing of foodstuffs and of consumption goods such as textiles. Man-power released by cutting production in consumption goods industries is being transferred to agriculture and war industries wherever the men are not being called up for army service. Polish labor as well as students and the German labor service, both male and female, has been used to harvest crops. The decline in exports of specialty goods has eased the shortage of skilled workers. Another factor relieving the labor demand has been the standardization of products, i.e., cutting down the varieties and numbers of models.

The chemical industry, highly organized before the war, is not having the transitional difficulties of some other industries, since considerable activity has already aimed to attain the highest possible degree of self-sufficiency.

A number of synthetic gasoline plants which have operated at low capacity because imported gasoline has been cheaper are now stepping up production. Last year Reich producers extracted 1,000,000 tons of gasoline from coal and lignite. It will be interesting to see what products developed in war time economy will remain once the war is over.

## Program to Honor Inventors And Research Workers

Leaders in the chemical field are among the members of the National Modern Pioneers Committee which has been appointed by Howard Coonley, chairman of the Walworth Co. and president of the National Association of Manufacturers, to sponsor a search for the nation's outstanding inventors and research workers who will be honored in connection with the observance of the 150th anniversary of the American patent system.

Among the members of the committee of more than 80 leading industrialists are: John F. Anderson, M.D. vice-president, E. R. Squibb & Sons, W. B. Bell, president, American Cyanamid Co., Lammot Du Pont, president, E. I. Du Pont de Nemours & Co., Roscoe C. Edlund, manager, Association of American Soap and Glycerine Producers Inc., C. F. Hockley, president, The Davison Chemical Co., Edgar M. Queeny, president, Monsanto Chemical Co., and Hiram S. Rivitz, president, Industrial Rayon Corp.

# PERSONALITIES

Kenneth H. Condit

✦ KENNETH H. CONDIT at present executive assistant to the president of the National Industrial Conference Board and formerly editor of *American Machinist* will succeed Prof. A. M. Greene as dean of the School of Engineering at Princeton University. He will assume his new duties in June.

✦ KLARE S. MARKLEY has been appointed principal chemist in the Oil, Fat and Protein Division of the Southern Regional Research Laboratory, at New Orleans.

✦ GEORGE N. TUTTLE has been appointed service representative for the Central Ohio Territory by the Porcelain Enamel and Mfg. Co. of Baltimore, Md. In recent years he has served as supervisor of the mill room and process control in the porcelain department of Frigidaire Division of General Motors Corp.

✦ GEORGE T. HORTON was elected president of the American Welding Society at the recent convention in Chicago. Mr. Horton is president of the Chicago Bridge and Iron Co.

✦ G. H. GEHRMANN, medical director of E. I. duPont de Nemours & Co., Wilmington, Del., and John H. Foulger, director of the Haskell Laboratory of Industrial Toxicology of the duPont company, have been appointed associate professors of industrial health at the Medical College of Virginia at Richmond.

✦ ROBERT E. WILSON, president of Pan American Petroleum & Transport Co., was presented the Chemical Industrial Medal for 1939 on November 11.

✦ RALPH E. PECK has been appointed instructor in the chemical engineering department of Armour Institute of Technology, Chicago. Dr. Peck was formerly at Drexel Institute of Technology.

✦ ERWIN H. AMICK has resigned his position with the Standard Oil Development Co. to accept an assistant professorship in chemical engineering at the University of Pennsylvania.

✦ RICHARD W. JACKSON, previously associate professor of biochemistry at Cornell Medical College, is now chief of the Protein Division, Eastern Regional Research Laboratory, Wyndmoor, Pa.

✦ ELBERT D. PECK, former first vice president and general manager of Devoe & Raynolds Co., has become associated with the Paint Division of the Pittsburgh Plate Glass Co. Mr. Peck will have headquarters at Pittsburgh. He will be detailed to special activities.

✦ JOSEPH M. LANG, vice president of the Phosphate Mining Co. of New York, has retired after an active service in the fertilizer industry of more than half a century. He is succeeded by Thomas M. Peters.

✦ HAROLD G. WOLFRAM has been appointed vice president of the Porcelain Enamel and Mfg. Co. He has been with Pemco for the past 15 years and has served as laboratory technician, director of research and recently as factory manager.

Charles M. A. Stine

✦ CHARLES M. A. STINE has been elected to receive the Perkin Medal of the Society of Chemical Industry for 1940. The medal is awarded annually for valuable work in applied chemistry. Shortly after graduating from Johns Hopkins, he entered the employ of E. I. duPont de Nemours & Co. He served as director of the chemical department until 1930, when he was elected vice president in charge of research. In the same year he became also a member of the Executive Committee, and Board of Directors. The medal will be presented on Jan. 12 1940, in New York City.

✦ RAY DEVOLUY, of the research organization at Stamford, Conn., of the American Cyanamid Co., has been transferred to the Organic Chemical Sales Division of the American Cyanamid & Chemical Co. in New York.

✦ D. W. MACCORQUODALE has resigned as assistant professor of biochemistry of St. Louis University School of Medicine to join the staff of Abbott Laboratories. Dr. MacCorquodale will be in charge of hormone research.

✦ REGINALD F. RICHARDS, general manager of the Phosphate Division of Monsanto Chemical Co., died October 25 at Barnes Hospital, St. Louis, after an illness of several months. Mr. Richards was born in 1884 at Buffalo. During his business career he was associated with General Chemical Co. from 1905 to 1933 in various positions connected with plant operation, being general manager at the time of his leaving to join Swann Chemical Co.

## CALENDAR

DEC. 4-9, CHEMICAL EXPOSITION, Grand Central Palace, New York City.
FEB. 19-22, 1940, TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY, annual meeting, Hotel Roosevelt, New York, N. Y.
APRIL, 8-12, 1940, AMERICAN CHEMICAL SOCIETY, annual meeting, Cincinnati, Ohio.
APRIL 24-27, 1940, ELECTROCHEMICAL SOCIETY, annual meeting, Galen Hall, Wernersville, Pa.
MAY, 1940, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Buffalo-Niagara Falls.

# Chemical ECONOMICS and MARKETS

## CONSUMPTION OF CHEMICALS REACHED HIGHEST POINT FOR YEAR IN OCTOBER

THE RISE in activity among industries which draw heavily upon chemicals as essential raw materials has advanced progressively from July to date. Consumption of chemicals, therefore, reached its peak for the year to date in October. Expressed in more definite terms, consumption in October was approximately 23 per cent higher than it had been in July. Chem. & Met's preliminary index for chemical consumption is 137 which compares with 130.13 for September, 123.23 for August, 113.74 for October 1938, and 131.19 for October 1937. Consumption in October was about 9 per cent below that for the peak month of 1937 but compares more favorably with the average of 138.22 for the first half of that year which was the record six-month period for the chemical industry.

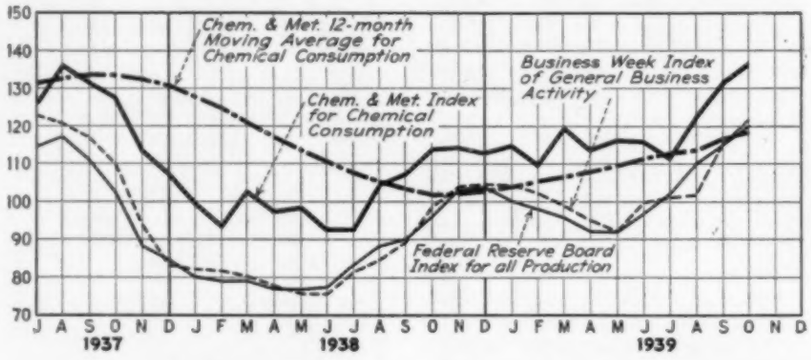
### *Chem. & Met.* Index for Consumption of Chemicals

| | August Revised | September |
|---|---|---|
| Fertilizer | 21.79 | 24.62 |
| Pulp and paper | 16.62 | 16.92 |
| Glass | 13.60 | 13.44 |
| Petroleum refining | 14.05 | 13.65 |
| Paint and varnish | 11.18 | 12.54 |
| Iron and steel | 7.76 | 9.21 |
| Rayon | 8.50 | 8.90 |
| Textiles | 8.01 | 8.07 |
| Coal products | 7.54 | 7.88 |
| Leather, glue and gelatine | 4.56 | 4.45 |
| Explosives | 4.77 | 5.24 |
| Rubber | 2.89 | 2.91 |
| Plastics | 1.96 | 2.30 |
| | 123.23 | 130.13 |

Increased demand for chemicals in October resulted from enlarged operations in practically all consuming industries. Steel and metallurgical requirements were especially heavy. Production of superphosphate was on a higher scale and rayon yarn output, including larger staple manufacture—which, incidentally, will be further increased by the opening of new plant capacity in the current month—helped in the widening use of chemicals. In the textile field, cotton and silk mills operated at a higher rate and in the glass trade, activity was reported for all branches with enlarged outputs of flat glass and glassware partly compensating for the less-than-seasonal drop in production of containers.

Touching upon industrial conditions, the Federal Reserve Board states that the rate of manufacture is now higher than at any time since 1929 and probably will continue at as rapid a pace until the end of the year at least. The Board estimates rate of production in October at 120 per cent of the 1923–25 average compared with 111 per cent for the preceding month and with 96 in October 1938. The *Business Week* index for general business activity is 121.3 for October as against a revised index of 115.3 for September.

The monthly report prepared by the Bureau of Census in cooperation with the National Association of Credit Men places manufacturers' dollar sales of all products in September at 13.4 per cent over those for August and 21.6 per cent over those for September 1938. Percentage increases for specified groups for the same periods were: chemicals and related products, 17.3 and 23.9; paints and varnishes, 6 and 23.6; pharmaceuticals and proprietary medicines, 26.1 and 7.5; textiles, 13.1 and 20.6; paper and paper products, 8.5 and 20.5; rubber products, 14.1 and 32.5; stone, clay and glass, 2.9 and 20.1; leather and products, 1.7 and 22.6; iron and steel, 15.2 and 42.9.

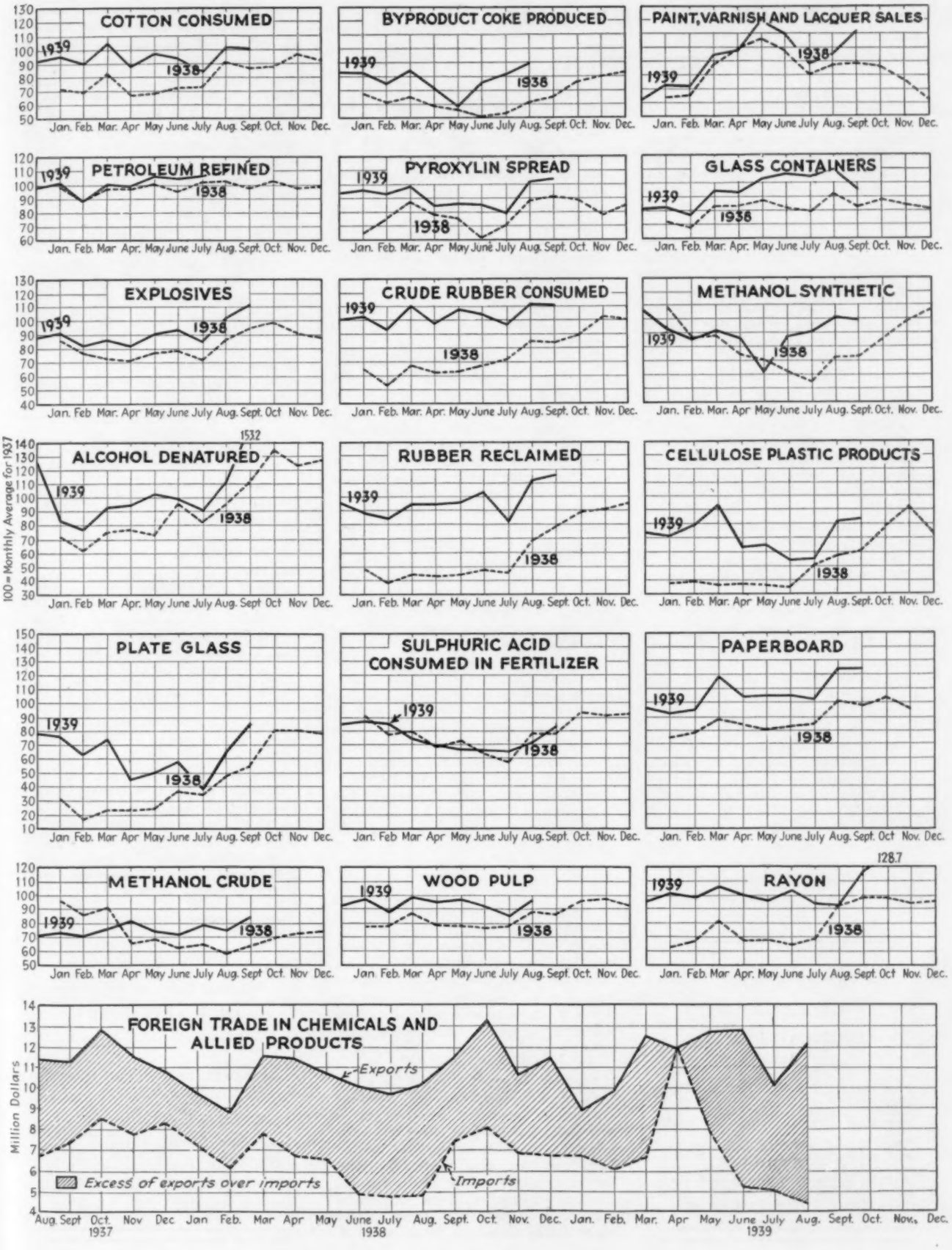

Chem. & Met. 12-month Moving Average for Chemical Consumption
Chem. & Met. Index for Chemical Consumption
Business Week Index of General Business Activity
Federal Reserve Board Index for all Production
150
140
130
120
110
100
90
80
70
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1937
1938
1939

### Production and Consumption Data for Chemical-Consuming Industries

| | Sept. 1939 | Sept. 1938 | January-Sept. 1939 | January-Sept. 1938 | Per cent of gain for 1939 |
|---|---|---|---|---|---|
| **Production** | | | | | |
| Alcohol, ethyl, 1,000 pr. gal. | 18,104 | 15,750 | 156,788 | 143,716 | 7.7 |
| Alcohol, denatured, 1,000 wi. gal. | 12,625 | 9,157 | 74,025 | 61,154 | 21.0 |
| Ammonia, liquor, 1,000 lb. | 3,946 | 3,439 | 33,671 | 28,749 | 17.1 |
| Ammonium sulphate, tons | 52,834 | 36,403 | 399,088 | 303,836 | 31.3 |
| Benzol, 1,000 gal. | 9,435 | 6,056 | 68,813 | 48,841 | 40.9 |
| Byproduct coke, 1,000 tons | 3,904 | 2,675 | 29,219 | 22,063 | 32.4 |
| Glass containers 1,000 gr | 4,250 | 3,653 | 37,989 | 32,014 | 18.7 |
| Plate glass, 1,000 sq. ft. | 13,663 | 8,873 | 89,159 | 47,282 | 88.6 |
| Methanol, synthetic, 1,000 gal. | 2,640 | 1,930 | 21,301 | 18,274 | 16.6 |
| Methanol, crude, 1,000 gal. | 405 | 303 | 3,283 | 3,133 | 4.8 |
| Nitrocellulose plastics, 1,000 lb. | 1,164 | 974 | 9,609 | 6,630 | 44.9 |
| Cellulose acetate plastics, 1,000 lb. | | | | | |
| Sheets, rods, and tubes | 706 | 592 | 6,716 | 3,443 | 95.1 |
| Molding material | 1,312 | 860 | 7,863 | 4,562 | 72.4 |
| Rubber reclaimed, tons | 17,990 | 12,985 | 134,343 | 74,551 | 80.2 |
| Steel barrels and drums, heavy, no. | 1,163,465 | 724,835 | 7,167,940 | 6,096,502 | 17.6 |
| Steel barrels and drums, light, no. | 254,041 | 160,009 | 1,767,182 | 1,437,767 | 22.9 |
| **Consumption** | | | | | |
| Cotton, bales | 624,902 | 533,399 | 5,308,779 | 4,198,361 | 26.4 |
| Silk, bales | 36,869 | 38,844 | 288,212 | 299,360 | 3.7* |
| Wool, 1,000 lb. | 33,853 | 26,005 | 285,438 | 180,823 | 57.8 |
| Explosives, 1,000 lb. | 35,933 | 30,443 | 265,801 | 230,518 | 15.3 |
| Rubber, crude, tons | 50,150 | 40,183 | 419,077 | 290,015 | 44.5 |

* Per cent of decline.

# Production and Consumption Trends



## PRICES FOR MANY CHEMICALS HAVE BEEN EXTENDED TO COVER 1940 DELIVERIES

ANNOUNCEMENTS to the effect that producers of different chemicals were prepared to accept contracts calling for delivery over next year is evidence of the stable price position of the market. Extension of contract commitments include such important chemicals as soda ash, caustic soda, chlorine, and bichromates. It is true that high prices have been paid in the spot market for certain selections which are well sold up but for the most part producers have continued to supply regular customers at unchanged prices. Price adjustments on the part of first hands, have been made in some instances where production costs made such action necessary or at least desirable. In some cases there has been a marking up of values because increased buying interest has lessened the sharp competition which had driven prices to a point too low to admit of profit margins. But generally considered, the market for chemicals has been but little disturbed by developments abroad and speculative influences which were prevalent in the World-War era have been held to a minimum.

The undercurrent to prices however is firm. In the first place, consuming requirements have been increased and this has relieved selling pressure and at the same time the trend has been toward higher production costs. For some chemicals new contract prices have not yet been made public because producers are waiting to see if current price levels for essential raw materials are well established. This is particularly true of some of the metal salts and may result in some advance in prices for future deliveries of important pigments.

The sharp rise in values for vegetable oils which started at the beginning of September has subsided and the market is again under normal influences. China wood oil is still held at very high prices in view of the limited offerings. Reserve stocks held in this country have been reduced in recent months and probably will be of small proportions by the end of the year. The high prices asked for this oil have turned attention to substitute oils and there appears to be a noteworthy replacement of wood oil by others which are recommended by their price advantage. Palm oil has not returned to its normal position and for the near future apparently will not carry its accustomed importance in our markets. Oils of domestic origin, including cottonseed, linseed, corn, peanut, and soybean have been in good demand and also in good supply.

In connection with recent buying orders it is reported that foreign orders for hospital supplies already placed would require two and one half years to fill if there were no increase in capacity. Increased capacity necessary to speed up these orders, it is stated, will be paid for entirely by the foreign buyers. Officials believe that nearly all American manufacturers will insist upon being compensated in advance, in one form or another, for any plant expansion that they undertake. There is no doubt in the minds of American procurement officers, now that the embargo has been lifted, that orders soon will exceed present plant capacity in the industries that naturally expand in time of war.

Transportation and storage facilities have become market factors of importance and one mistake the railroads made during the last war will not be repeated. So many freight cars were used for storage that acute car shortages were the rule. If the war in Europe should result in a heavy load being thrown on the transportation machine both management and the Interstate Commerce Commission are determined not to permit an accumulation of freight. Cars will not be furnished for loading until it is certain that they can be unloaded.

With the knowledge that freight cars would have to be unloaded promptly the munitions board has given the question of storage careful consideration. It has been found that mass distribution has not been developed in this country to the same extent as mass production. The munitions board is urging manufacturers to provide adequate storage at their plants. The board is faced with a more difficult task of providing storage at terminals.

Foreign demand for American chemicals and related products increased sharply in September and resulted in exports of a number of chemicals, items advancing in value as much as 100 per cent compared with September, 1938, according to the Bureau of Foreign and Domestic Commerce. Total exports of such products aggregated $20,000,000 in value during the month, which was a 40 per cent increase over the $14,300,000 recorded in September of last year.

By classes the largest gain was recorded in exports of industrial chemicals, shipments of which were valued at $4,151,700 in September compared with $1,940,000 in the corresponding month of last year. In this group, shipments of sodium compounds increased from 42,000,000 to 94,000,000 lb.

Among exports of coal-tar products, shipments of dyes, colors, stains, and similar products advanced sharply to 1,023,750 lb. valued at $610,000 in September from 494,000 lb. valued at $321,700 in the corresponding month of last year. Total exports of all coal-tar products in September, including dyes, were valued at $1,114,000 against $1,021,000 in the same month of 1938—the gain recorded in dyes and similar products being offset by a sharp decline in exports of benzol, shipments of which decreased from 1,833,000 gal. in September 1938 to 48,000 gal. this year.

Among the fertilizers, exports of potash materials advanced sharply to 17,214 tons valued at $639,500 in September from 4,189 tons valued at $139,300 in the corresponding month of last year. Total exports of all fertilizers in September, including potash, were valued at $1,944,000 in September compared with $1,326,000 in the corresponding month of last year.

Among the imports recording decreases, potash materials was outstanding, due mainly to Germany's inability to supply these materials. Receipts of such products aggregated 15,877 tons valued at $408,111 in September, against 42,391 tons valued at $1,302,000 in the corresponding month of 1938. Imports of all types of fertilizer materials, including potash, were valued at $1,983,000 in September compared with $3,427,000 in the same month of 1938.

Declines in other chemical imports occurred with coal-tar products, including dyes, receipts of which declined in value from $1,623,000 in September 1938 to $1,494,000 during the month under review; and industrial chemicals, from $1,732,300 to $1,254,000.

### CHEM. & MET.

**Weighted Index of**

### CHEMICAL PRICES

Base = 100 for 1937

| | |
|---|---|
| **This month** | **97.73** |
| Last month | 97.56 |
| November, 1938 | 98.90 |
| November, 1937 | 100.09 |

Scarcity of offerings has kept the spot market for some chemicals in a nominal position but actual price changes in the last month have been few in number and the weighted price index was but moderately higher.

### CHEM. & MET.

**Weighted Index of Prices for**

### OILS AND FATS

Base = 100 for 1937

| | |
|---|---|
| **This month** | **80.76** |
| Last month | 82.15 |
| November, 1938 | 71.80 |
| November, 1937 | 85.84 |

Many of the oils sold at lower levels including crude cottonseed and linseed. China wood oil still commands high prices but buying interest has lessened and substitute oils are being used to a greater extent. Some of the animal oils and fats also were reduced in price.

# Current PRICES

## INDUSTRIAL CHEMICALS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Acetone, drums, lb. | $0.07 -$0.07½ | $0.06 -$0.06½ | $0.05½-$0.06½ |
| Acid, acetic, 28%, bbl., cwt. | 2.23 - 2.48 | 2.23 - 2.48 | 2.23 - 2.48 |
| Glacial 99%, drums. | 8.43 - 8.68 | 8.43 - 8.68 | 8.43 - 8.68 |
| U. S. P. reagent. | 10.25 -10.50 | 10.25 -10.50 | 10.25 -10.50 |
| Boric, bbl., ton. | 106.00-111.00 | 106.00-111.00 | 106.00-111.00 |
| Citric, kegs, lb. | .20 - .23 | .20 - .23 | .23½- .26 |
| Formic, bbl., ton. | .10½- .11 | .10½- .11 | .10½- .11 |
| Gallic, tech., bbl., lb. | .70 - .75 | .70 - .75 | .70 - .75 |
| Hydrofluoric 30% carb., lb. | .07 - .07½ | .07 - .07½ | .07 - .07½ |
| Lactic, 44%, tech., light, bbl., lb. | .06½- .06¾ | .06½- .06¾ | .06½- .06¾ |
| Muriatic, 18°, tanks, cwt. | 1.05 -..... | 1.05 -..... | 1.05 -..... |
| Nitric, 36°, carboys, lb. | .05 - .05½ | .05 - .05½ | .05 - .05½ |
| Oleum, tanks, wks., ton. | 18.50 -20.00 | 18.50 -..... | 18.50 -20.00 |
| Oxalic, crystals, bbl., lb. | .10½- .12 | .10½- .12 | .10½- .12 |
| Phosphoric, tech., c'boys., lb. | .07½- .08½ | .07½- .08½ | .09 - .10 |
| Sulphuric, 60° tanks, ton. | 13.00 -..... | 13.00 -..... | 13.00 -..... |
| Sulphuric, 66°, tanks, ton. | 16.50 -..... | 16.50 -..... | 16.50 -..... |
| Tannic, tech., bbl., lb. | .40 - .45 | .40 - .45 | .40 - .45 |
| Tartaric, powd., bbl., lb. | .31½-..... | .31½-..... | .27½-..... |
| Tungstic, bbl., lb. | 2.35 -..... | 2.35 -..... | 2.75 -..... |
| Alcohol, Amyl. | ....- | ....- | ....- |
| From Pentane, tanks, lb. | .101-..... | .101-..... | .106-..... |
| Alcohol, Butyl, tanks, lb. | .08 -..... | .08 -..... | .08½-..... |
| Alcohol, Ethyl, 190 p'f., bbl., gal. | 4.54 -..... | 4.54 -..... | 4.58½-..... |
| Denatured, 190 proof. | | | |
| No. 1 special, bbl., gal. wks. | .28½-..... | .28½-..... | .30 -..... |
| Alum, ammonia, lump, bbl., lb. | .03½- .04 | .03½- .04 | .03½- .04 |
| Potash, lump, bbl., lb. | .03½- .04 | .03½- .04 | .03½- .04 |
| Aluminum sulphate, com. bags, cwt. | 1.15 - 1.40 | 1.15 - 1.40 | 1.15 - 1.40 |
| Iron free, bg., cwt. | 1.30 - 1.55 | 1.30 - 1.55 | 1.30 - 1.55 |
| Aqua ammonia, 26°, drums, lb. | .02½- .03 | .02 - .03 | .02½- .03 |
| tanks, lb. | .02 - .02½ | .02 - .02½ | .02½- .02½ |
| Ammonia, anhydrous, cyl., lb. | .16 -..... | .15½-..... | .15½-.16 |
| tanks, lb. | .04½-..... | .04½-..... | .04½-.16 |
| Ammonium carbonate, powd. tech., casks, lb. | .09 - .12 | .09 - .12 | .08 - .12 |
| Sulphate, wks, cwt. | 1.40 -..... | 1.40 -..... | 1.375-..... |
| Amylacetate tech., tanks, lb. | .10½-..... | .10½-..... | .11 -..... |
| Antimony Oxide, bbl., lb. | .17 - .18 | .17 - .18 | .11½- .12 |
| Arsenic, white, powd., bbl., lb. | .03 - .03½ | .03 - .03½ | .03 - .03½ |
| Red, powd., kegs, lb. | .15½- .16 | .15½- .16 | .15½- .16 |
| Barium carbonate, bbl., ton. | 52.50 -57.50 | 52.50 -57.50 | 52.50 -57.50 |
| Chloride, bbl., ton. | 79.00 -81.00 | 79.00 -81.00 | 79.00 -81.00 |
| Nitrate, casks, lb. | .07 - .08 | .07 - .08 | .07 - .08 |
| Blanc fixe, dry, bbl., lb. | .03½- .04 | .03½- .04 | .03½- .04 |
| Bleaching powder, f. o. b., wks., drums, cwt. | 2.00 - 2.10 | 2.00 - 2.10 | 2.00 - 2.10 |
| Borax, gran., bags, ton. | 48.00 -51.00 | 48.00 -51.00 | 48.00 -51.00 |
| Bromine, cs., lb. | .30 - .32 | .30 - .32 | .30 - .32 |
| Calcium acetate, bags. | 1.90 -..... | 1.75 -..... | 1.65 - 1.75 |
| Arsenate, dr., lb. | .06½- .07 | .06½- .07 | .06½- .07 |
| Carbide drums, lb. | .05 - .06 | .05 - .06 | .05 - .06 |
| Chloride, fused, dr., del., ton. | 21.50 -24.50 | 21.50 -24.50 | 21.50 -24.50 |
| flake, dr., del., ton. | 23.00 -25.00 | 23.00 -25.00 | 23.00 -25.00 |
| Phosphate, bbl., lb. | .07½- .08 | .07½- .08 | .07½- .08 |
| Carbon bisulphide, drums, lb. | .05 - .06 | .05 - .06 | .05 - .06 |
| Tetrachloride drums, lb. | .04½- .05½ | .04½- .05½ | .05½- .06 |
| Chlorine, liquid, tanks, wks., lb. | 1.75 -..... | 1.75 -..... | 2.15 -..... |
| Cylinders. | .05½- .06 | .05½- .06 | .05½- .06 |
| Cobalt oxide, cans, lb. | 1.84 - 1.87 | 1.67 - 1.70 | 1.67 - 1.70 |
| Copperas, bgs., f. o. b., wks., ton. | 17.00 -18.00 | 15.00 -16.00 | 15.00 -16.00 |
| Copper carbonate, bbl., lb. | .10 - .16½ | .10 - .16½ | .09 - .16 |
| Sulphate, bbl., cwt. | 4.75 - 5.00 | 4.75 - 5.00 | 4.50 - 4.75 |
| Cream of tartar, bbl., lb. | .25½-..... | .25½-..... | .22½-..... |
| Diethylene glycol, dr., lb. | .22 - .23 | .22 - .23 | .22 - .23 |
| Epsom salt, dom., tech., bbl., cwt. | 1.80 - 2.00 | 1.80 - 2.00 | 1.80 - 2.00 |
| Ethyl acetate, drums, lb. | .061-..... | .061-..... | .06½-..... |
| Formaldehyde, 40%, bbl., lb. | .05½- .06½ | .05½- .06½ | .05½- .6½ |
| Furfural, tar ks, lb. | .09 -..... | .09 -..... | .09 -..... |
| Fusel oil, ref. drums, lb. | .16 - .17 | .12½- .14 | .12½- .14 |
| Glaubers salt, bags, cwt. | .95 - 1.00 | .95 - 1.00 | .95 - 1.00 |
| Glycerine, c.p., drums, extra, lb. | .12½-..... | .12½-..... | .16½-..... |
| Lead: | | | |
| White, basic carbonate, dry casks, lb. | .07 -..... | .07 -..... | .06½-..... |
| White, basic sulphate, sck., lb. | .06½-..... | .06½-..... | .06 -..... |
| Red, dry, sck., lb. | .08 - ..... | .08 - ..... | .08 -..... |
| Lead acetate, white crys., bbl., lb. | .11 - .12 | .11 - .12 | .10 - .11 |
| Lead arsenate, powd., bbl., lb. | .10 - .10½ | .10 - .10½ | .11 - .11½ |
| Lime, chem., bulk, ton. | 8.50 -..... | 8.50 -..... | 8.50 -..... |
| Litharge, pwd., csk., lb. | .07 -..... | .07 -..... | .066-..... |
| Lithophone, bags, lb. | .04 - .04½ | .04 - .04½ | .04½- .05 |
| Magnesium carb., tech., bags, lb. | .06 - .06½ | .06 - .06½ | .06 - .06½ |

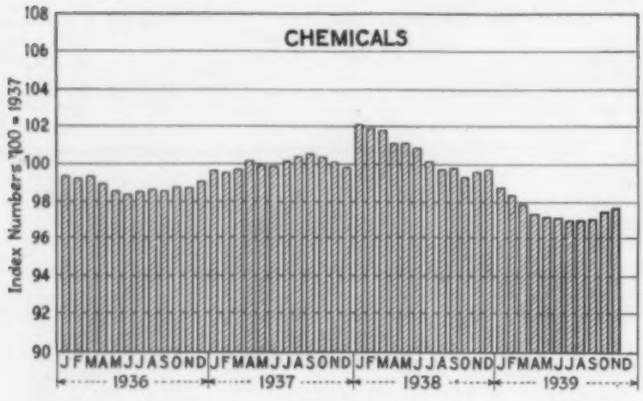
| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Methanol, 95%, tanks, gal. | .31 -..... | .31 -..... | .31 -..... |
| 97%, tanks, gal. | .32 -..... | .32 -..... | .32 -..... |
| Synthetic, tanks, gal. | .33 -..... | .33 -..... | .33 -..... |
| Nickel salt, double, bbl., lb. | .13 - .13½ | .13 - .13½ | .13 - .13½ |
| Orange mineral, csk., lb. | .10½-..... | .10½-..... | .10½-..... |
| Phosphorus, red, cases, lb. | .40 - .42 | .40 - .42 | .40 - .42 |
| Yellow, cases, lb. | .18 - .25 | .18 - .25 | .24 - .30 |
| Potassium bichromate, casks, lb. | .08½- .09 | .08½- .09 | .08½- .09 |
| Carbonate, 80-85%, calc. csk., lb. | .06½- .07 | .06½- .07 | .06½- .07 |
| Chlorate, powd., lb. | nom. | nom. | .09½-..... |
| Hydroxide (c'stic potash) dr., lb. | .07 - .07½ | .07 - .07½ | .07 - .07½ |
| Muriate, 80% bgs., unit. | .53½-..... | .53½-..... | .53½-..... |
| Nitrate, bbl., lb. | .05½- .06 | .05½- .06 | .05½- .06 |
| Permanganate, drums, lb. | .18½- .19 | .18½- .19 | .18½- .19 |
| Prussiate, yellow, casks, lb. | .15 - .16 | .15 - .16 | .15 - .16 |
| Sal ammoniac, white, casks, lb. | .05 - .05½ | .05 - .05½ | .05 - .05½ |
| Salsoda, bbl., cwt. | 1.00 - 1.05 | 1.00 - 1.05 | 1.00 - 1.05 |
| Salt cake, bulk, ton. | 13.00 -15.00 | 13.00 -15.00 | 13.00 -15.00 |
| Soda ash, light, 58%, bags, contract, cwt. | 1.05 -..... | 1.05 -..... | 1.05 -..... |
| Dense, bags, cwt. | 1.10 -..... | 1.10 -..... | 1.10 -..... |
| Soda, caustic, 76%, solid, drums, cwt. | 2.30 - 3.00 | 2.30 - 3.00 | 2.30 - 3.00 |
| Acetate, works, bbl., lb. | .04 - .05 | .04 - .05 | .04½- .05 |
| Bicarbonate, bbl., cwt. | 1.70 - 2.00 | 1.70 - 2.00 | 1.75 - 2.00 |
| Bichromate, casks, lb. | .06½- .07 | .06½- .07 | .06½- .07 |
| Bisulphate, bulk, ton. | 15.00 -16.00 | 15.00 -16.00 | 15.00 -16.00 |
| Bisulphite, bbl., lb. | .03½- .04 | .03½- .04 | .03½- .04 |
| Chlorate, kegs, lb. | .06½- .06¾ | .06½- .06¾ | .06½- .06¾ |
| Cyanide, cases, dom., lb. | .14 - .15 | .14 - .15 | .14 - .15 |
| Fluoride, bbl., lb. | .07½- .08 | .07½- .08 | .07½- .08 |
| Hyposulphite, bbl., cwt. | 2.40 - 2.50 | 2.40 - 2.50 | 2.40 - 2.50 |
| Metasilicate, bbl., cwt. | 2.20 - 3.20 | 2.20 - 3.20 | 2.20 - 3.20 |
| Nitrate, bulk, cwt. | 1.35 -..... | 1.35 -..... | 1.45 -..... |
| Nitrite, casks, lb. | .06½- .07 | .06½- .07 | .07 - .08 |
| Phospate, tribasic, bags, lb. | 2.00 -..... | 2.00 -..... | 1.85 -..... |
| Prussiate, yel. drums, lb. | .10½- .11 | .10½- .11 | .09½- .10 |
| Silicate (40° dr.) wks., cwt. | .80 - .85 | .80 - .85 | .80 - .85 |
| Sulphide, fused, 60-62%, dr., lb. | .02½- .03½ | .02½- .03 | .02½- .03 |
| Sulphite, crys., bbl., lb. | .02½- .02¾ | .02½- .02¾ | .02½- .02¾ |
| Sulphur, crude at mine, bulk, ton. | 16.00 -..... | 16.00 -..... | 18.00 -..... |
| Chloride, dr., lb. | .03 - .04 | .03 - .04 | .03 - .04 |
| Dioxide, cyl., lb. | .07 - .08 | .07 - .08 | .07 - .07½ |
| Flour, bag, cwt. | 1.60 - 3.00 | 1.60 - 3.00 | 1.60 - 3.00 |
| Tin Oxide, bbl., lb. | nom. | .54 -..... | .50 -..... |
| Crystals, bbl., lb. | .38½-..... | .50½-..... | .36½-..... |
| Zinc, chloride, gran., bbl., lb. | .05 - .06 | .05 - .06 | .05 - .06 |
| Carbonate, bbl., lb. | .14 - .15 | .14 - .15 | .14 - .15 |
| Cyanide, dr., lb. | .33 - .35 | .33 - .35 | .33 - .35 |
| Dust, bbl., lb. | .08½-..... | .08½-..... | .06½-..... |
| Zinc oxide, lead free, bag., lb. | .06½-..... | .06½-..... | .06½-..... |
| 5% lead sulphate, bags, lb. | .06½-..... | .06½-..... | .06½-..... |
| Sulphate, bbl., cwt. | 2.75 - 3.00 | 2.75 - 3.00 | 3.15 - 3.60 |

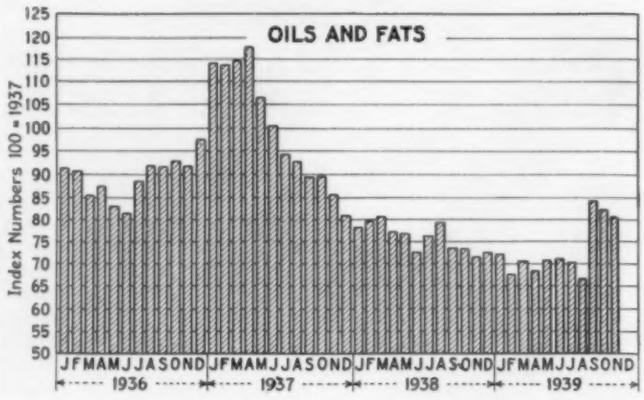
## OILS AND FATS

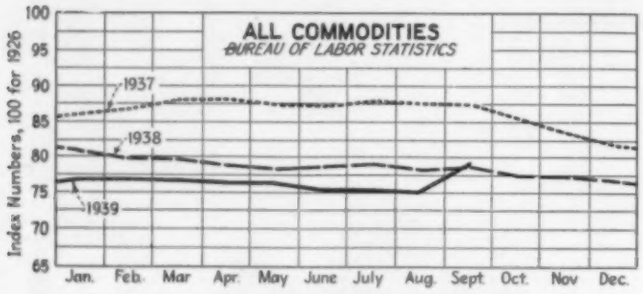
| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Castor oil, 3 bbl., lb. | $0.10 -$0.10½ | $0.08½-$0.10 | $0.09½-$0.10 |
| Chinawood oil, bbl., lb. | .27 -..... | .28 -..... | .14 -..... |
| Coconut oil, Ceylon, tank, N. Y., lb. | .03½-..... | .04 -..... | .03 -..... |
| Corn oil crude, tanks (f. o. b. mill), lb. | .05½-..... | .06½-..... | .06½-..... |
| Cottonseed oil, crude (f. o. b. mill), tanks, lb. | .05½-..... | .05½-..... | .06½-..... |
| Linseed oil, raw car lots, bbl., lb. | .099-..... | .105-..... | .083-..... |
| Palm, casks, lb. | .05½-..... | .05½-..... | .036-..... |
| Peanut oil, crude, tanks (mill), lb. | .07 -..... | .07 -..... | .06½-..... |
| Rapeseed oil, refined, bbl., gal. | 1.00 -..... | .95 -..... | .78 -..... |
| Soya bean, tank, lb. | .05 -..... | .05½-..... | .05½-..... |
| Sulphur (olive foots), bbl., lb. | .10 -..... | .10 -..... | .06½-..... |
| Cod, Newfoundland, bbl., gal. | nom. | nom. | .38 -..... |
| Menhaden, light pressed, bbl., lb. | .074-..... | .076-..... | .063-..... |
| Crude, tanks (f. o. b. factory), gal. | .35 -..... | .36 -..... | .30 -..... |
| Grease, yellow, loose, lb. | .05½-..... | .05½-..... | .04½-..... |
| Oleo stearine, lb. | .08½-..... | .09 -..... | .06½-..... |
| Oleo oil, No. 1. | .08 -..... | .08½-..... | .09½-..... |
| Red oil, distilled, d.p. bbl., lb. | .09 -..... | .09 -..... | .08½-..... |
| Tallow extra, loose, lb. | .06 -..... | .06 -..... | .05½-..... |

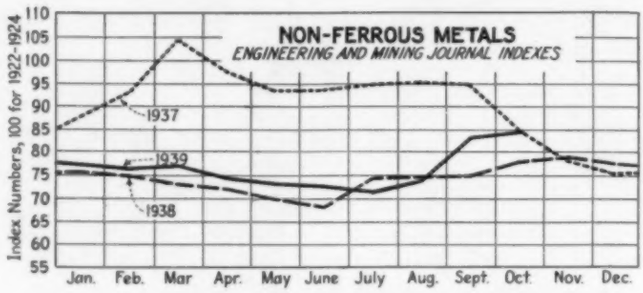
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Nov. 15

# Chem. & Met.'s Weighted Price Indexes




## COAL-TAR PRODUCTS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Alpha-napthol, crude bbl., lb. | $0.52 -$0.55 | $0.52 -$0.55 | $0.52 -$0.55 |
| Alpha-naphthylamine, bbl., lb. | .32 - .34 | .32 - .34 | .32 - .34 |
| Aniline oil, drums, extra, lb. | .15 - .16 | .15 - .16 | .15 - .16 |
| Aniline, salts, bbl., lb. | .22 - .24 | .22 - .24 | .22 - .24 |
| Benzaldehyde, U.S.P., dr., lb. | .85 - .95 | .85 - .95 | .85 - .95 |
| Benzidine base, bbl., lb. | .70 - .75 | .70 - .75 | .70 - .75 |
| Benzoic acid, U.S.P., kgs., lb. | .54 - .56 | .54 - .56 | .54 - .56 |
| Benzyl chloride, tech., dr., lb. | .23 - .25 | .23 - .25 | .23 - .25 |
| Benzol, 90%, tanks, works, gal. | .16 - .18 | .16 - .18 | .16 - .18 |
| Beta-napthol, tech., drums, lb. | .23 - .24 | .23 - .24 | .23 - .24 |
| Cresol, U.S.P., dr., lb. | .09½- .10 | .09½- .10 | .10½- .11 |
| Cresylic acid, dr., wks., gal. | .58 - .60 | .58 - .60 | .78 - .80 |
| Diethylaniline, dr., lb. | .40 - .45 | .40 - .45 | .40 - .45 |
| Dinitrophenol, bbl., lb. | .23 - .25 | .23 - .25 | .23 - .25 |
| Dinitrotoluen, bbl., lb. | .15 - .16 | .15 - .16 | .15 - .16 |
| Dip oil, 15%, dr., gal. | .23 - .25 | .23 - .25 | .23 - .25 |
| Diphenylamine, bbl., lb. | .32 - .36 | .32 - .36 | .32 - .36 |
| H-acid, bbl., lb. | .50 - .55 | .50 - .55 | .50 - .55 |
| Naphthalene, flake, bbl., lb. | .05½- .06 | .05½- .06 | .05½- .06 |
| Nitrobenzene, dr., lb. | .08 - .09 | .08 - .09 | .08 - .09 |
| Para-nitraniline, bbl., lb. | .47 - .49 | .47 - .49 | .47 - .49 |
| Phenol, U.S.P., drums, lb. | .13 -..... | .13 -..... | .14½-..... |
| Picric acid, bbl., lb. | .35 - .40 | .35 - .40 | .35 - .40 |
| Pyridine, dr., gal. | 1.55 - 1.60 | 1.55 - 1.60 | 1.55 - 1.60 |
| Resorcinal, tech., kegs, lb. | .75 - .80 | .75 - .80 | .75 - .80 |
| Salicylic acid, tech., bbl., lb. | .33 - .40 | .33 - .40 | .33 - .40 |
| Solvent naptha, w.w., tanks, gal. | .26 -..... | .26 -..... | .26 -..... |
| Tolidine, bbl., lb. | .86 - .88 | .86 - .88 | .88 - .90 |
| Toluene, drums, works, gal. | .27 -..... | .27 -..... | .27 -..... |
| Xylene, com, tanks, gal. | .26 -..... | .26 -..... | .26 -..... |

## MISCELLANEOUS

| | Current Price | Last Month | Last Year |
|---|---|---|---|
| Barytes, grd., white, bbl., ton. | $22.00-$25.00 | $22.00-$25.00 | $22.00-$25.00 |
| Casein, tech., bbl., lb. | .20 - .22 | .20 - .22 | .08½- .11 |
| China clay, dom., f.o.b. mine, ton. | 8.00 -20.00 | 8.00 -20.00 | 8.00 -20.00 |
| Dry colors | | | |
| Carbon gas, black (wks.), lb. | .02½- .30 | .02½- .30 | .02½- .30 |
| Prussian blue, bbl., lb. | .36 - .37 | .36 - .37 | .36 - .37 |
| Ultramarine blue, bbl., lb. | .10 - .26 | .10 - .26 | .10 - .26 |
| Chrome green, bbl., lb. | .21 - .30 | .21 - .30 | .21 - .27 |
| Carmine red, tins, lb. | 4.85 - 5.00 | 4.85 - 5.00 | 4.00 - 4.40 |
| Para toner, lb. | .75 - .80 | .75 - .80 | .75 - .80 |
| Vermilion, English, bbl., lb. | 2.70 - 2.90 | 2.70 - 2.90 | 1.50 - 1.55 |
| Chrome yellow, C.P., bbl., lb. | .14½- .15½ | .14½- .15½ | .14½- .15½ |
| Feldspar, No. 1 (f.o.b. N.C.), ton. | 6.50 - 7.50 | 6.50 - 7.50 | 6.50 - 7.50 |
| Graphite, Ceylon, lump, bbl., lb. | .06 - .06½ | .06 - .06½ | .06 - .06½ |
| Gum copal Congo, bags, lb. | .07 - .30 | .07 - .30 | .06 - .30 |
| Manila, bags, lb. | .08 - .15 | .08 - .14 | .09 - .14 |
| Damar, Batavia, cases, lb. | .08 - .20 | .08 - .20 | .08 - .24 |
| Kauri cases, lb. | .18 - .60 | .18 - .60 | .18½- .60 |
| Kieselguhr (f.o.b. N. Y.), ton. | 50.00 -55.00 | 50.00 -55.00 | 50.00 -55.00 |
| Magnesite, calc, ton. | 50.00 -..... | 50.00 -..... | 50.00 -... |
| Pumice stone, lump, bbl., lb. | .05 - .07 | .05 - .08 | .05 - .07 |
| Imported, casks, lb. | .03 - .04 | .03 - .04 | .03 - .04 |
| Rosin, H., bbl. | 6.85 -..... | 6.70 -..... | 6.55 -..... |
| Turpentine, gal. | .31½-..... | .33 -..... | .29 -..... |
| Shellac, orange, fine, bags, lb. | .25 -..... | .25 -..... | .20 -..... |
| Bleached, bonedry, bags, lb. | .24 -..... | .24 -..... | .19 -..... |
| T. N. Bags, lb. | .16 -..... | .16 -..... | .10½-..... |
| Soapstone (f.o.b. Vt.), bags, ton. | 10.00 -12.00 | 10.00 -12.00 | 10.00 -12.00 |
| Talc, 200 mesh (f.o.b. Vt.), ton. | 8.00 - 8.50 | 8.00 - 8.50 | 8.00 - 8.50 |
| 300 mesh (f.o.b. Ga.), ton. | 7.50 -10.00 | 7.50 -10.00 | 7.50 -11.00 |
| 225 mesh (f.o.b. N. Y.), ton. | 13.75 -..... | 13.75 -..... | 13.75 -..... |

## INDUSTRIAL NOTES

Stauffer Chemical Co., and associated companies, Dominguez Chemical Co., Pacific Hard Rubber Co., and Western Molded Products, Inc., have moved their offices in Los Angeles to 555 South Flower St.

Cutler-Hammer, Inc., Milwaukee, has appointed Terry Fisher to take charge of the territory in northern Indiana with headquarters in South Bend.

John A. Roebling's Sons Co., Trenton, N. J., has moved its office in New York to 19 Rector St.

American-British Chemical Supplies, Inc., New York, has elected John T. Ames as vice-president to succeed the late E. H. Watson. Mr. Ames also is vice-president of Charles Tennant & Co. and of Kay-Fries Chemicals, Inc.

American Locomotive Co., New York, has appointed C. S. Patton sales manager of the Alco Products Division.

Cooper Alloy Foundry Co., Elizabeth, N. J., has added Frank F. Bonnevier and C. T. Coffman to its staff.

The Welin Davit and Boat Corp., Newark, N. J., has purchased a plant from the National Lead Co. at Perth Amboy. The plant will be operated by a subsidiary, Alloy Fabricators, Inc., and later on the Welin company will move to the new address.

The Yale & Towne Mfg. Co., New York, has promoted Henry D. Rolph to the position of director of export sales with headquarters in the Chrysler Bldg.

American I. G. Chemical Corp., New York, has changed its name to General Aniline & Film Corp.

Hydro-Power Systems, Inc., Mount Gilead, Ohio, has recently established its general offices in the Grant Bldg., Pittsburgh, Pa.

# New CONSTRUCTION

| | Current Projects | | Cumulative 1939 | |
|---|---|---|---|---|
| | Proposed Work | Contracts | Proposed Work | Contracts |
| New England | ..... | $855,000 | $1,335,000 | $1,838,000 |
| Middle Atlantic | $185,000 | 1,095,000 | 6,515,000 | 16,657,000 |
| South | 225,000 | 900,000 | 12,533,000 | 10,635,000 |
| Middle West | 280,000 | 500,000 | 15,945,000 | 16,375,000 |
| West of Mississippi | 8,010,000 | 875,000 | 15,945,000 | 14,871,000 |
| Far West | 65,000 | 200,000 | 2,335,000 | 3,472,000 |
| Canada | ..... | 400,000 | 8,960,000 | 5,455,000 |
| Total | $8,765,000 | $4,825,000 | $63,568,000 | $69,303,000 |

## PROPOSED WORK

**Aluminum Sulphate Plant**—Consolidated Chemical Industries, S. M. Stelling, Local Mgr., Bastrop, La., will build addition to plant here. $50,000.

**Cellophane Film Plant**—E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del., plans to construct a plant for the manufacture of cellophane film at Clinton, Ia. Contract for 7,500 cu.yd. excavation has been let to A. M. Paulson, Clinton. Total estimated cost $7,000,000.

**Chemical Plant**—Reichold Chemical Co., Ferndale, Mich., is having plans prepared by Giffels & Vallet, Inc., Engrs., 1000 Marquette Bldg., Detroit, for a plant and office building.

**Gas Plant Improvements**—Citizens Gas Co., Salisbury, Md., plans improvements to gas plant, including blowers and other equipment, also pipe line replacements and extensions in distribution system.

**Gas Development**—Syndicate c/o C. E. Updegraff, Engr., Hotel Samuels, Jamestown, N. Y., plans extensive development of Oriskany sand natural gas producing area in Potter Co., near Coudersport, Pa., including drilling 5,000 ft. wells requiring 3,500 to 4,000 ft. 6¼ in. pipe. $40,000.

**Glass Factory**—General Electric Co., c/o W. E. Davidson, local representative, Jackson, Miss., plans to construct glass factory and assembling plant for lights here. $50,000.

**Gas Recycling Plant**—Agua Dulce Gas Co., Agua Dulce, Tex., plans to expand its plant. Cost will exceed $40,000.

**Recycling Plant**—Process Oil Co., Stratton and Corpus Christi, Tex., plans to enlarge its plant near Stratton. $150,000.

**Oil Development**—Milburn E. Anderson, Old Post Office Bldg., Warren, Pa., plans to construct gas or water pressure plants for forcing crude from old oil wells on property at Fieldmore Springs, near Titusville, Pa., including extensive drilling and reconditioning old wells. Cost will exceed $25,000.

**Oil Refinery**—Champlin Refining Co., Rock Rapids, Ia., plans to construct refinery, storage department, etc. $250,000.

**Oil Refinery**—Forest Oil Co., Forest Oil Bldg., Bradford, Pa., and Minard Run Oil Co., Bradford, plan to construct huge pressure plant in Music Mt. oil field, Lewis Run near Bradford, to return natural gas to earth under pressure to force recovery of crude oil from wells. Cost including equipment will exceed $40,000.

**Oil Refinery**—Lockhart Bros., Agua Dulce, Tex., and Milam Bldg., San Antonio, Tex., plan to construct 35,000,000 ft. recycling plant at Agua Dulce. $250,000.

**Paint Factory**—Armstrong Paint & Varnish Co., 1350 South Kilbourn Ave., Chicago, Ill., plan to construct a 60x100x100 ft. top addition to its factory. $40,000.

**Paint Factory**—Doidge-Koren Paint Co., Alemany and Bay Shore Blvds., San Francisco, Calif., plans to construct addition to its plant. Cost will exceed $40,000.

**Phosphate Plant**—Harpeth Valley Chemical Co., c/o John H. Kresge, 400 Warner Bldg., Nashville, Tenn., plans to build plant at Franklin, Tenn. $125,000.

**Powder Factory**—National Powder Co., Eldred, Pa., plans to construct new plant for manufacture of nitro-glycerin and office building. T. K. Hendryx, 165 Interstate Pkway., Bradford, Archt. Cost will exceed $40,000.

**Pipe Line**—Continental Oil Co., Ponca City, Okla., and Corpus Christi, Tex., will soon receive bids for replacing 26 mi. of 8 in. pipe line from Montgomery Co. to terminal at Corpus Christi. Pipe (5⅛ in.) taken up will be used to connect wells in Duval Co. with company's main line. $70,000.

**Crude Oil Pipe Line**—Inland Empire Refineries, Spokane, Wash., is having surveys made by Williams Bros., National Bank of Tulsa Bldg., Tulsa, Okla., for a pipe line from Cut Bank, Mont., to Spokane, Wash. Cost will exceed $25,000.

**Soy Bean Processing Plant**—Plymouth Processing Co., Fort Dodge, Ia., plans to rebuild plant recently destroyed by fire with loss of $250,000.

**Soy Bean Mill**—Swift & Co., 4115 South Packers St., Chicago, Ill., has acquired a site at Fostoria, O., and plans to construct a mill to have a capacity of 400,000 bu. Cost will exceed $200,000.

## CONTRACTS AWARDED

**Caustic Soda Plant**—Canadian Industries, Ltd., 1135 Beaver Hall Hill, Montreal, Que., Can., has awarded the contract for a caustic soda finishing plant at Shawinigan Falls, Que., to Fraser-Brace Engineering Co., Ltd., 107 Craig St., Montreal. $400,000.

**Cement Plant**—Lone Star Cement Co., c/o L. J. Wheeler, Mgr., Box 1718, Houston, Tex., has awarded contract for addition to cement plant, to Tellepson Construction Co., 3900 Clay St., Houston. $150,000.

**Chemical Plant**—J. T. Baker Chemical Co., 535 North Broad St., Phillipsburg, N. J., has awarded the contract for two chemical manufacturing buildings, 1 story, 60x100 ft. and 40x100 ft., to M. A. Carty, Sigsbee Ave., Alpha, N. J.

**Chemical Plant**—Monsanto Chemical Co., Chemical Lane, Everett, Mass., has awarded the contract for a plant to W. M. Bailey Co., 89 Broad St., Boston. $50,000.

**Chemical Process Plant**—Pittsburgh Coke & Iron Co., Neville Island, Pittsburgh, Pa., A. M. Kennedy, Vice Pres. in charge, has awarded the contract for a chemical processing plant to Koppers Co., Koppers Bldg., Pittsburgh. $300,000.

**Cork Factory**—Armstrong Cork Co., Lancaster, Pa., has awarded the contract for a factory at South Braintree, Mass., to McCreery & Thoriault, 303 Columbus Ave., Boston, Mass. Cost will exceed $40,000.

**Factory**—Michigan Limestone & Chemical Co., Katherine St., Buffalo, N. Y., will construct a factory at Buffalo. Work will be done by separate contracts.

**Factory**—Northam Warren Corp., 191 Hudson St., New York, N. Y., has awarded contract for factory at Stamford, Conn., to Dyker Building Corp., 122 East 42nd St., New York, N. Y., at $765,000.

**Gas Development**—Hanley & Bird, F. E. Eckert, Mgr., Kennedy St., Bradford, Pa., will build a gas development at Canisteo, N. Y. Work will be done by separate contracts. $40,000.

**Gas Wells**—New York Natural Gas Corp., Ithaca, N. Y., plans to drill wells and lay pipe line near Danby, N. Y. Work will be done by owner's forces. Cost will exceed $25,000.

**Hortenspheroid Plant**—Warren Petroleum Co., Corpus Christi, Tex., will construct plant on ship channel to handle high gravity condensate. Work will be done by purchase and hire system. $75,000.

**Laboratory**—Corning Glass Works, Walnut St., Corning, N. Y., has awarded the contract for a 5 story, 80x125 ft. laboratory to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. $125,000.

**Laboratory**—Merck & Co., 126 West Lincoln Ave., Rahway, N. J., has awarded contract for altering and constructing 2 story, 50x80 ft. addition to research laboratory to Oschwald Construction Co., 854 Clinton Ave., Newark; 1 story drum storage building to Salmond-Schrimshaw Construction Co., 526 Elm St., Arlington.

**Oil Refinery**—Kendall Refining Co., Box 364, Bradford, Pa., has awarded the contract for a 1 story, 28x35 ft. addition to Carl E. Swanson, Bradford. Cost including equipment $40,000.

**Oil Refinery**—J. J. Sheerin, 700 Olmos Dr. E., San Antonio, Tex., R. T. Wilson, Amarillo and Associates, have awarded the contract for drilling over 90,000 lin. ft. oil and gas wells in area from Stratton fields to Agua Dulce area in Neuces Co., Agua Dulce, to J. F. Camp Drilling Co., National Bank of Commerce Bldg., San Antonio, at $525,000.

**Oil Refinery**—United Refining Co., P. O. Box 780, Warren, Pa., will alter and improve its Swan-Finch refinery at Warren. Work will be done by day labor and separate contracts.

**Recycling Plant**—Corpus Christi Corp., c/o W. A. Warren, Pres. Corpus Christi and Stratton, Tex., is building 10,000,000 cu.ft. unit to plant near Stratton. Work is being done by purchase and hire plan. $125,000.

**Pipe Line**—Standard Oil Co., D. H. George, Div. Mgr., 1801 East First St., Dayton, O., will construct 6 in. gasoline pipe line between Dayton and Springfield, O., with own forces. $250,000.

**Paper Mill**—Hammermill Paper Co., Lake Shore Rd., Erie, Pa., has awarded the contract for a 2 story, 83x290 ft. addition to mill to Henry Shenk Co., Erie, $75,000.

**Paper Mill**—International Paper Co., 220 East 42nd St., New York, N. Y., has awarded contract for addition to mill at Corinth, N. Y., to Duplex Construction Co., Glen St., Glens Falls, N. Y. Estimated cost will exceed $40,000.

**Paper Mill**—Stevens Paper Mills, Inc., Rainbow, Conn., has awarded the contract for a 1 story, 87x170 ft. addition to its mill to R. F. Jones Co., 15 Lewis St., Hartford, Conn. $40,000.

**Pulp Mill**—Everett Pulp & Paper Co., Everett, Wash., has awarded the contract for a building to house pulp screen equipment and multi-stage pulp bleaching plant to Howard S. Wright & Co., 407 Yale Ave., N., Seattle, Wash. $200,000.

**Pulp Mill**—North Carolina Pulp Co., Plymouth, N. C., has awarded the contract for a finishing plant, heater room, etc., to W. Muirhead Construction Co., Box 2010, Durham, N. C., and Richmond, Va. $800,000.

**Rubber Factory**—Ohio Rubber Co., F. G. Smith, Mgr., Willoughby, O., has awarded the contract for an addition to its factory to Gordon C. Rutland, Lost Nation Rd., Willoughby. $100,000.

**Mill Warehouse**—Alton Box Board & Paper Co., G. G. Otto, Pres., Alton, Ill., has awarded the contract for a 1 story, 116x690 ft. mill warehouse to Heilrung Construction Co., Alton. Estimated cost $150,000.

**Tobacco Warehouse**—Brown & Williamson Tobacco Corp., 16 and Hill Sts., Louisville, Ky., has awarded the contract for two 1 story warehouses to Struck Construction Co., 147 North Clay St., Louisville. $100,000.

**Warehouse**—National Gypsum Co., Delaware Ave., Buffalo, N. Y., has awarded the contract for a 1 and 2 story, 100x300 ft. warehouse and board mill to George R. Fuller Co., 599 Madison Ave., New York, N. Y. $250,000.

# IMPORT STATISTICS FOR 1938 SHOW IMPORTANCE OF GERMANY AS A SUPPLIER OF CHEMICALS

**ing the years of the World War offers proof of the progress this country has made toward self-sufficiency in chemical manufacture. The line along which further progress should be directed has been accentuated by the experience of recent weeks. Already there is evidence that our dependence upon foreign sources of supply will be materially reduced by development of home production.**

A DETAILED report on imports of chemicals into this country has been recently issued by the Chemical Division of the Bureau of Foreign and Domestic Commerce. This compilation refers to the calendar year 1938 and for the majority of chemicals included gives totals both for quantities and values. In addition to these totals there is added in each case, the amount and value of such importations which came from Germany. The comparison thus afforded brings out clearly the importance of Germany as a supplier of chemicals for domestic markets. Total value for the items for which data are given amounts to approximately $45,000,000 of which amount nearly 42 per cent represents shipments from German ports.

Reference to the tabular presentation reveals that in several instances, our 1938 imports were 100 per cent of German origin. In this category are such selections as formic acid, calcined magnesium sulphate—both fertilizer and non-fertilizer grades—ago salts, ethylene dibromide, synthetic camphor, and urea. This list might be further extended by the inclusion of chemicals, imports of which are practically 100 per cent from Germany. Among them may be mentioned bleached shellac, low-grade kainite, and potassium nitrate.

While the greater part of chemicals which are imported, enters our markets under competitive conditions with home production capable of taking care of all consuming requirements, there are other imports which either enjoy a monopoly because there is no home production or are necessary adjuncts to home outputs because the latter are not large enough to satisfy the needs of consuming industries. Immediately following the outbreak of hostilities in Europe and the disruption of normal ocean shipping, domestic markets for certain chemicals became more or less nominal due to the scarcity of spot and nearby offerings.

Further reference to the table for imports shows that this condition applied largely to the selections which are obtained entirely or in large part from Germany. Moreover, import figures for 1938 should be viewed in the perspective of present industrial conditions. Demand for chemicals in this country this year has been running about 20 per cent above the 1938 level and it is logical to assume that domestic consumption of certain imported chemicals has been expanded to a similar extent. Hence the elimination of imports or the cutting down of shipments from abroad carries more significance at present when requirements run to larger volumes.

The sharp contrast between conditions at present and those which prevailed dur-

**Total Chemical Imports and Imports from Germany in 1938**

| | | Total | | From Germany | |
|---|---|---|---|---|---|
| | | Quantity | Value | Quantity | Value |
| Formic acid | lb. | 587,947 | $41,213 | 587,947 | $41,213 |
| Other acids and acid anhydrides, n. e. s. | lb. | 414,377 | 53,901 | 318,514 | 37,488 |
| All alkaloids, salts and derivatives, n. e. s. | lb. | 3,942 | 70,311 | 3,069 | 48,897 |
| Medicinal substances of animal origin (oxgall, bile compounds, gland extracts | lb. | 15,971 | 370,538 | 8,146 | 163,484 |
| Medicinal preparations, n. s. p. f. not containing alcohol | value | ..... | 544,742 | ..... | 153,689 |
| Calcined magnesium sulphate or calcined kieserite (not fertilizer) | lb. | 6,386,795 | 66,470 | 6,386,795 | 66,470 |
| Chemical elements, compound, mixtures and salts, n. s. p. f., not alcoholic | value | ..... | 566,713 | ..... | 379,910 |
| Ammonium chloride (muriate) | lb. | 6,781,647 | 160,400 | 4,784,764 | 114,896 |
| Casein or lacterene and mixtures | lb. | 411,246 | 27,610 | 1,991 | 1,319 |
| Preparations in capsules, pills, etc., in medicinal doses, non-coal-tar | value | ..... | 485,852 | ..... | 95,288 |
| Coal-tar acids, n. s. p. f | lb. | 411,354 | 328,589 | 367,881 | 264,361 |
| Azo salts (inc. diazo salts and varinmine blue salts) | lb. | 148,919 | 190,333 | 148,919 | 190,333 |
| Fast color bases | lb. | 83,460 | 97,583 | 82,916 | 96,710 |
| Fast color salts | lb. | 210,726 | 162,017 | 148,591 | 109,033 |
| Napthol A. S. and derivatives | lb. | 108,323 | 233,412 | 103,639 | 225,068 |
| All similar coal-tar products, n. e. s. | lb. | 1,024,269 | 1,085,007 | 897,103 | 936,140 |
| Finished coal-tar products | | | | | |
| Alizarin, synthetic, colors, dyes, stains | lb. | 3,316,387 | 5,061,132 | 2,013,582 | 2,718,539 |
| Coal-tar medicinals | lb. | 39,407 | 166,124 | 18,053 | 92,955 |
| Photographic chemicals | lb. | 26,239 | 271,817 | 16,254 | 248,981 |
| Cobalt oxide | lb. | 373,215 | 519,201 | 141,375 | 202,715 |
| Photographic gelatin valued at 40¢ or more per lb | lb. | 737,639 | 686,523 | 507,432 | 487,155 |
| Glue, n. s. p. f. valued at less than 40¢ per lb | lb. | 1,003,413 | 93,099 | 205,606 | 24,397 |
| Glycerin, crude | lb. | 9,723,371 | 711,167 | 8,530 | 726 |
| refined | lb. | 2,567,411 | 218,560 | 607 | 404 |
| Ethylene dibromide | lb. | 1,210,005 | 263,459 | 1,210,005 | 263,459 |
| Camphor, synthetic | lb. | 563,773 | 207,102 | 563,773 | 207,102 |
| Paints, colors, pigments and stains, n. s. p. f | lb. | 238,984 | 101,300 | 83,082 | 72,208 |
| Barytes ore, crude | short tons | 16,498 | 123,657 | 3,750 | 27,188 |
| Iron-oxide and iron hydroxide pigments, n. s. p. f. synthetic | lb. | 3,500,329 | 183,436 | 1,992,713 | 91,215 |
| Potassium carbonate | lb. | 583,120 | 30,981 | 428,842 | 23,335 |
| Potassium chlorate | lb. | 13,219,895 | 781,106 | 10,821,315 | 672,055 |
| Potassium hydroxide | lb. | 972,669 | 79,128 | 836,036 | 53,707 |
| Potassium ferricyanide | lb. | 195,102 | 42,814 | 78,705 | 19,221 |
| Potassium nitrate or saltpeter, ref'd | lb. | 2,083,892 | 100,509 | 1,890,782 | 93,097 |
| Sodium sulphate, anhydrous | ton | 5,788 | 116,514 | 5,766 | 115,916 |
| Sodium chlorate | lb. | 5,156,164 | 220,015 | 1,620,231 | 94,208 |
| Sodium sulphide, more than 35% | lb. | 3,017,251 | 68,918 | 2,483,450 | 58,162 |
| Fatty acids, n. s. p. f | lb. | 4,144,080 | 139,044 | 610,705 | 35,821 |
| Bone ash, dust, etc., for fertilizer | ton | 19,581 | 393,808 | 5,273 | 102,529 |
| Crude coal-tar products | | | | | |
| Dead or creosote oil | gal. | 55,391,590 | 6,316,029 | 7,159,220 | 848,572 |
| Cresylic acid | gal. | 1,227,876 | 648,590 | 255,873 | 144,986 |
| Naphthalene solidifying less than 79 deg. C | lb. | 29,966,305 | 529,178 | 8,693,329 | 152,915 |
| Cryolite or kryolith | ton | 12,155 | 785,606 | 333 | 63,027 |
| Sodium cyanide | lb. | 26,387,452 | 2,403,823 | 5,566,971 | 487,664 |
| Cyanide salts and mixtures, n. s. p. f. | lb. | 81,793 | 25,246 | 76,281 | 23,590 |
| Fertilizer materials | | | | | |
| Nitrogenous n. s. p. f., inc. hoof-meal | ton | 65,715 | 1,101,489 | 15,565 | 287,490 |
| Compounded or chemically combined nitrogen, phosphoric acid and potash | ton | 7,384 | 347,401 | 4,478 | 265,363 |
| Calcined magnesium sulphate and mixtures | ton | 14,221 | 110,867 | 14,220 | 110,843 |
| Kadaya (karaya) and talka | lb. | 4,810,937 | 522,013 | 606,260 | 153,829 |
| Unbleached shellac | lb. | 12,374,702 | 1,089,551 | 427,748 | 60,855 |
| Bleached shellac | lb. | 178,196 | 27,139 | 178,084 | 27,119 |
| Cod oil | gal. | 3,057,860 | 939,481 | 244,340 | 106,645 |
| Cod-liver oil | gal. | 5,228,637 | 3,326,496 | 930,154 | 408,314 |
| Medicinal mineral oil from petroleum | gal. | 896,578 | 665,550 | 422,148 | 396,714 |
| Potash fertilizer materials | | | | | |
| Chloride | ton | 199,591 | 5,371,600 | 98,326 | 2,666,542 |
| Kainite 14% | ton | 359 | 2,528 | 359 | 2,528 |
| Kainite 20% | ton | 53,403 | 523,229 | 28,739 | 278,714 |
| Manure salts 30% | ton | 8,187 | 112,713 | 4,090 | 59,120 |
| Sulphate, crude | ton | 53,442 | 1,910,319 | 35,054 | 1,253,183 |
| Sulphate, magnesia | ton | 11,748 | 281,691 | 11,725 | 280,986 |
| Nitrate crude | ton | 13,079 | 680,602 | 12,554 | 661,299 |
| Quinine sulphate | oz. | 977,278 | 514,928 | 153,500 | 85,846 |
| Sodium sulphate, crude | ton | 127,160 | 1,331,966 | 93,406 | 1,509,020 |
| Urea | ton | 1,123 | 125,275 | 1,123 | 125,275 |